

# AGRICULTURAL ENGINEERING

OCTOBER • 1948

Sixteen Years of Research in Sugar Beet  
Mechanization *H. B. Walker*

Recent Developments in Precast-Concrete  
Septic Tanks *W. G. Kaiser*

A National Cooperative Plumbing Pro-  
gram for Rural Areas *Earl L. Arnold*

Special Equipment for the Application of  
Soil Fumigants *Robert R. Owen*

Characteristics of Durable Concrete Drain  
Tile for Acid Soils *D. G. Miller*

*ASAE Winter Meeting • Chicago—December 13-15, 1948*



THE JOURNAL OF THE AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS

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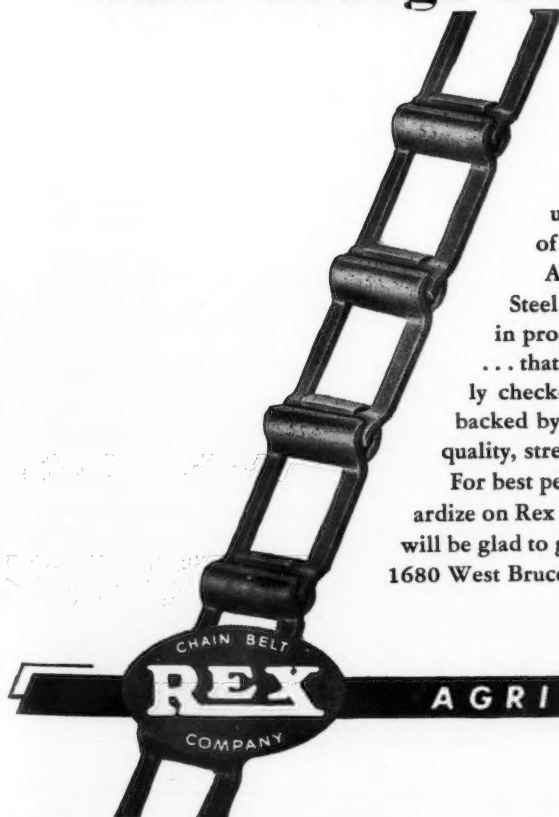
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# AGRICULTURAL ENGINEERING

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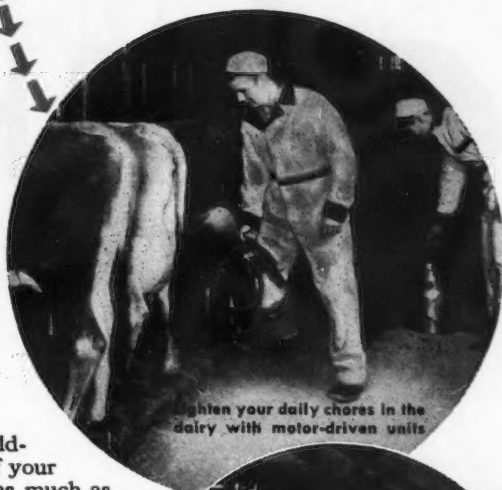
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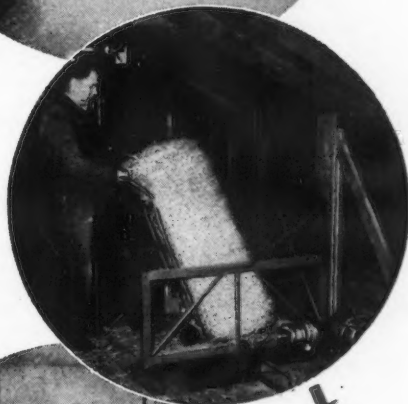
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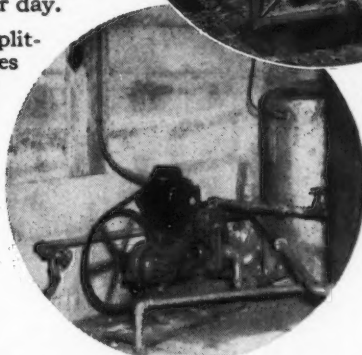
**YOUR G-E farm and home dealer** has these motors for you now. He will help you select the right motor to do a score of hard jobs for you. *Farm Industry Division, General Electric Company, Schenectady, N. Y.*



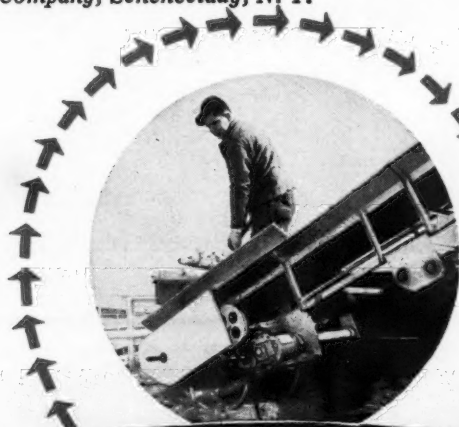
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Replace your block-and-tackle hoists with push-button elevators



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One motor can do several different types of jobs because it's light-weight, adaptable

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GENERAL  ELECTRIC



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says Richard E. Carney, Girard, Ill., farmer

Would *you* trade 2 hours of back-breaking work for 2 extra hours of freedom? That's what Richard E. Carney did. Made all his barn chores easier, too — and boosted his milk checks 10%!

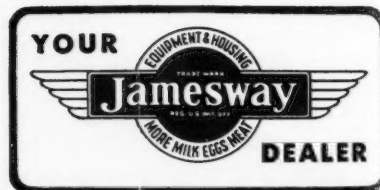
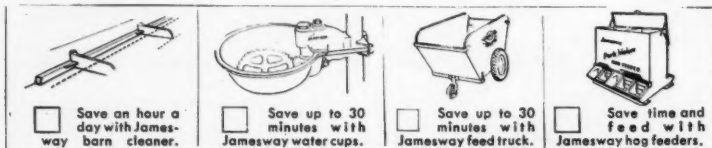
"I figure that my Jamesway barn will pay for itself pretty quick in time saved alone," says Mr. Carney. "Jamesway water cups save me an hour a day, my Jamesway feed truck saves 30\* minutes, stalls and stanchions another half hour."

"What's more, with Jamesway ventilation, I don't have to run around opening and closing windows with every change in the weather. There are no drafts. So I can keep my herd of registered cows in healthy condition."

Now's the time for you, too, to save time the Jamesway. End the expensive, back-breaking way of doing chores. Jamesway equipment costs surprisingly little. Gives years and years of service. Ask your dealer!



"I wouldn't be without my Jamesway feed truck," says Mr. Carney. "It does in one trip what once required 13 trips with a bushel basket."



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Manufacturer of Barn  
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# Novel machine "Plants" fertilizer under grass roots of pasture



**Profitable Invention:** Mr. Fay Mowery's pasture fertilizing machine, which he designed and built, places the fertilizer where it will do the most good — just below the grass roots. The result — better grass.

## Rancher solves problem of how to grow Better Grass

The idea that he would grow a lot better grass if he could place the fertilizer just below the grass roots, instead of on top of the sod, started Fay Mowery, ingenious rancher of Alameda, Texas, to work in his ranch shop.

The result is the novel machine shown above that can "plant" 500 pounds of fertilizer per acre just below the grass roots without damaging the sod. Built of parts of farm implements with a home-made fertilizer box, the machine covers 25 acres a day.

The big improvement in grass has already more than paid for the time and labor in building the machine, according to Mr. Mowery, former 4-H Gold Star boy of Harris County.

Like keen ranchers and farmers the country over, Mr. Mowery has also discovered that *it pays to farm with Texaco Products.*



**Rugged Tire:** Many Texaco Farm Men serve the farmer's tire needs too. Farmers around Thibodaux, La., have learned that it pays to depend on Texaco Man Nolan Gaubert, shown here with Mr. W. Benoit and Mr. A. Chaisson, prominent local farmers.

**Nice Family:** Mr. Mowery lubricates as Mrs. Mowery and daughters look on. Only Marfak lubricant is good enough for Mr. Mowery's farm implements and tractors, because Marfak sticks to bearings better, lasts longer.



**Mr. T. J. Stockstill,** popular Texaco Man of Wenatchee, Washington, loads up with Texaco Fire-Chief, the gasoline with superior "Fire-Power," and other Texaco Products, to give his farm customers the timely and friendly service that's typical the country over.

**Farmers Everywhere** prefer Marfak lubricant once they find out how much better and longer it stays on bearings. That's why you see Mr. O. E. Everson, prominent farmer of Whiting, Ia., giving his tractor a "shot" as Joseph G. Stangel, his friendly Texaco Man, stands by.



Tune in . . . TEXACO STAR THEATER every Wednesday night starring Milton Berle. See newspaper for time and station.

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\*Reg. U. S. Pat. Off.



## EDITORIAL

### Rural Electric Engineering

**S**UGGESTIONS received for the rural electric program of the ASAE Winter Meeting indicate a continued wide diversity of honest opinion as to the major interests of the Society's Rural Electric Division. Evident interests ranged all the way from research with radioactive isotopes, to sales techniques, equipment do's and don'ts, and handy-man hookups which a farm boy might complete between chore times on a rainy Saturday.

This suggests a little backtracking toward fundamentals on which we may agree, and from which we may again proceed with better mutual understanding.

Rural electrification involves considerable engineering, and a number of other interests and activities which distinctly do not fall within commonly accepted definitions of engineering.

Many individual members of the Division have strong and legitimate interests in the various non-engineering aspects of rural electrification. They are concerned with techniques of teaching, extension, promotion, sales, finance, journalism, power generation, installations, wiring, and service, as applied to increasing and improving farm use of electricity.

It does not necessarily follow that the Division can or should attempt to serve these non-engineering interests of its members, any more than it should attempt to serve their individual interests in the Spanish language or ballroom dancing.

In fact, there is some ground for a belief that an engineering society can be of greater service to its members by concentrating closely on their engineering interests, rather than by trying to be all things to all of its people.

What are the classes of subjects which are definitely or potentially rural electric engineering interests? They may be grouped as agricultural objectives, electrical and related engineering means, and the application engineering of reduction to practice.

In agricultural objectives we are more concerned with specific basic data from agricultural science than with an assortment of philosophic viewpoints. Electricity can be used by farmers to help them get various jobs done "while the moon is right." But until agricultural science shows and measures the specific influences of the moon on farm operations, we cannot be satisfied that this is the most advantageous farm use of electricity.

We need more information on the possibilities of using various electrical effects to improve conditions for crop, livestock, and human performance, and to improve resulting farm production in yield, quality, processing refinement, packaging, preservation, and initial delivery. We need more information on farm conditions and objectives in terms of measured, quantitative physical, chemical, biological, and economic values defining the starting and end points, and significant accomplishments of farm operations and functions which are being or might be served by electric power. These are the navigating data for technical progress in rural electrification.

Electrical and related mechanical and structural engineering are the basic means by which rural electrification can be steered in the direction of progress toward objectives defined by agricultural science.

They include work in electrical engineering aimed specifically at improving the technological foundation of rural electrification—work toward improving the ways and means of handling and applying electricity to better utilize its direct and indirect effects in achieving some of the above objectives.

They justify our keeping an eye on other technical progress in electrical engineering which might incidentally be of direct use improving the means and methods of rural electrification.

They support a parallel interest in the accessory engineering of mechanisms and structures by which electricity is controlled and put to work.

The application engineering of reduction to rural electric practice may be given various functional names.

One example is distribution engineering, particularly from

the 110-220-volt side of the transformer to points of use. In this the engineering basis of distribution system design might be distinguished from the trade practices and skills of installation, and from the farm routines of operating the system.

Reduction to practice also involves the engineering foundation for sound and improved practices in the electrical trades as applied in servicing farms. In this the engineering interest of the Division should be clearly distinguished from the incidental interest of individual members in knowing established trade skills and practices, and in trade questions not involving engineering considerations.

Sales engineering approaches to technically and economically sound promotion of rural electrification can be useful engineering tools. The technically sound use of engineering physical data, and of related economic and biological data, to arrive at a quantitative evaluation of a proposed purchase, use, or installation, under carefully defined conditions, is legitimately an engineering interest.

As an interest of the Division, the engineering functions of introducing rural electrification to farm practice might well be distinguished from the various and important non-engineering activities contributing to the same end.

It is true that engineering progress in rural electrification may sometimes be delayed, awaiting the solution to various non-engineering problems; awaiting the support and encouragement which result from genuine acceptance and profitable use of existing engineering developments; or awaiting appreciation of engineering opportunities by non-engineering guardians of purse strings.

In these circumstances the critical non-engineering interests and activities of rural electrification may, with some advantage, be examined from an engineering viewpoint.

But can any such diversion of attention of the whole Division be justified except by a clear emergency? It seems that under ordinary circumstances the engineering interests and the engineering talents of the Rural Electric Division might be combined and utilized most effectively in its activities by concentration on the abundance of engineering problems, accomplishments, and opportunities in rural electrification.

### Increasing Farm Product Use Values

**S**OIL deficiency influences on crop values are not entirely new to agricultural engineers. The newer indications that trace elements are significant in farm crop, animal, and human nutrition have been brought to our attention by Arnold P. Yerkes, a past-president of the American Society of Agricultural Engineers, and by others at various times.

The subject is of inherent interest to agricultural engineers as a matter influencing over-all efficiency in the farm production of genuine economic and social values. It is readily apparent that food value per bushel of wheat is as much a factor in its production efficiency as bushels per acre, per man-hour, or per dollar of production cost. Standard measures and market grades can be accepted only as convenient approximates of the use value in farm products. Weight, volume, and grade are only rough indications of the extent to which real production objectives have been achieved.

Further, there are strong indications that supplying trace elements needed for quality generally has a direct favorable influence on yield and cost of production per unit.

It seems that nutritionists have now carried the subject to a point of interest and recognition which is beginning to be felt in increasing support for needed research.

Agricultural engineers will be able to help in that research, in basic analysis and execution of sound approach, wherever it may involve physical factors in the soil, subsoil, soil moisture, related environment, timing, distribution, harvesting, or conditioning and processing of various parts of new or common crop plants in various stages of maturity. Those factors will require instrumentation, implementation, manipulation, measurements, and controls specifically within the province of engineering.

(Continued on page 452)

## SMOOTHING OUT HAY FIELD WRINKLES

**H**ERE'S THE START of better hay crops, with faster, more economical harvesting and less wear on haying equipment! A 43-horsepower "Caterpillar" Diesel D4 pulls a heavy-duty 10½-foot offset cover crop disk and a homemade float, chopping and smoothing 60 acres of rough grassland, so that bigger crops of hay can be produced and harvested more easily. The economical Diesel, working in 4th gear, covers 3½ acres per hour on 2¼ gallons of fuel.

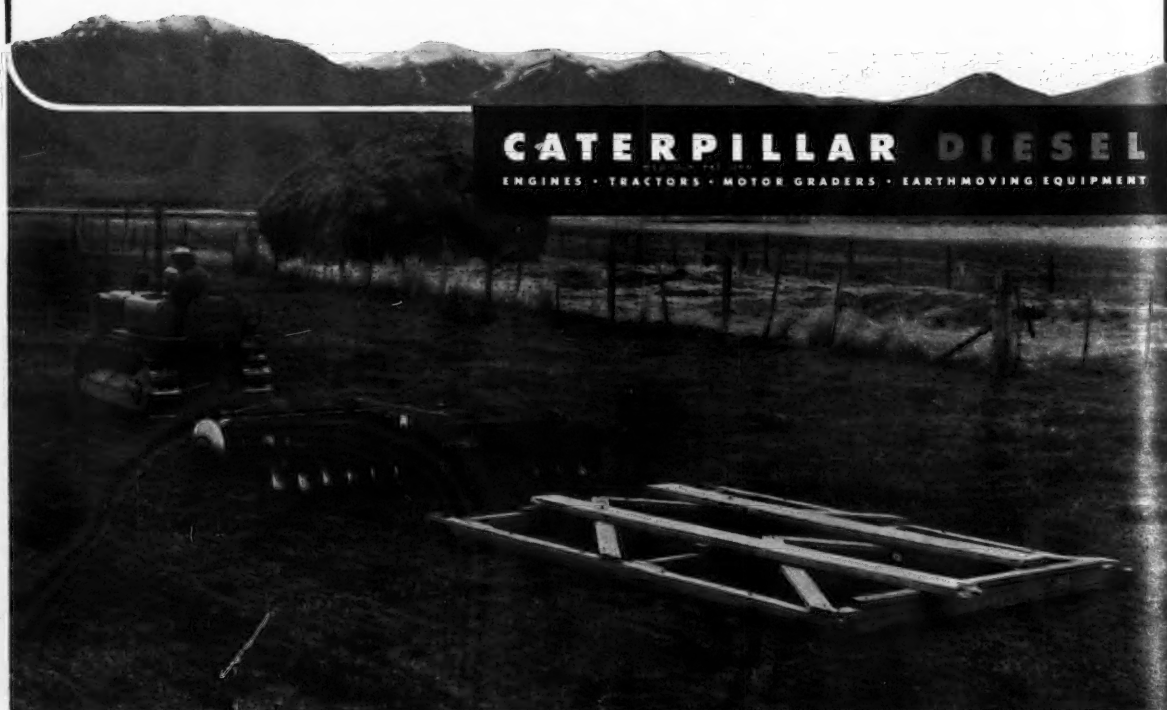
The D4 is owned by Willis Brothers, Paradise Valley, Nevada, who contract for ranch rehabilitation work in cooperation with the U. S. Soil Conservation Service. Willis Brothers also own a "Caterpillar" Diesel D6 and a "Caterpillar" No. 60 Scraper, with which they clear land, build

stock ponds and do other earthmoving jobs.

Rehabilitation projects, from smoothing fields to filling gullies, has always been profitable work for "Caterpillar" owners. It makes the most of their machines' ability to operate through dust, mud and cold—to work a field without waiting for treacherous soft spots to dry—to "harness" engine power over loose footing. And generous drawbar pull—20% more of it in the new D2, D4 and D6—allows owners to use bigger hitches, get more work done in less time, at less cost.

Add these features to a long working life and it's easy to see why "Caterpillar" Diesels are the favorite for soil conservation and rehabilitation work. They save dollars while they save crop land!

CATERPILLAR TRACTOR CO., PEORIA, ILL.



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# AGRICULTURAL ENGINEERING

VOL. 29

OCTOBER, 1948

No. 10

## A Resume of Sixteen Years of Research in Sugar-Beet Mechanization

By H. B. Walker

FELLOW A.S.A.E.

**T**HE sugar-beet industry of this nation, which grows and processes upwards of three-fourths million acres of sugar beets each year, has been handicapped with an uneven labor demand in crop production.

Labor peaks appear twice yearly, once in the spring during the blocking, thinning, and weeding season, and again during the harvesting season. I shall present to you briefly a resume of 16 years of research designed to overcome these handicaps. This project was initiated at the California Agricultural Experiment Station in 1931 in cooperation with the Agricultural Engineering Division of the U. S. Department of Agriculture. It was conducted as a cooperative project until 1943. Since that time it has been carried on exclusively by the California station.

The project has been important to the sugar-beet industry because of its economic significance. It serves also as an example of research achievement resulting from coordinated efforts between state and federal agencies with advisory assistance and financial support from industry. Altogether some 20 investigators and technicians have made contributions to the project, although at no time have more than 12 persons worked concurrently. A list of the contributing research personnel is appended.

In the initial stages only limited funds were available. Later, however, grants were received from the U. S. Beet Sugar Association which, together with state and federal funds, provided adequate research support. These funds totaled for the 16-yr period, approximately \$250,000, of which about 45 per cent was supplied through industrial grants. Because of the timing of the grants and the influence of the available funds on the rate of project prosecution, two periods of activity will be used in presenting this resume: (1) the early investigational period extending from the project's inception in 1931 to mid-1938 and (2) an accelerated research period extending from mid-1938 to date.

The only difference in the significance of these periods is the intensity of research effort. It was in the second period that funds from the U. S. Beet Sugar Association became available, and an advisory committee from that industry was set up, to aid in a consulting capacity. While the broad objectives for mechanization were well defined in the original pro-

An address presented before the annual meeting of the American Society of Agricultural Engineers at Portland, Ore., June, 1948.

H. B. WALKER is professor of agricultural engineering, University of California, and agricultural engineer, California Agricultural Experiment Station.

ject statement, changes in method of attack were frequent due to the development of new research techniques.

The first period was inherently exploratory in nature. This, however, should not detract from the importance of these early studies, which did much to reveal the control problems involved. Mervine, Walker, and McBirney analyzed the labor problems confronting sugar-beet growers and the preliminary tests were designed to reveal the most promising research attacks. These were undertaken vigorously during the second phase of the investigations.

Mervine should be credited with the first analytical studies of the blocking and thinning of sugar beets by hand and mechanical means. In 1931 he conducted cross-blocking experiments with ordinary beet cultivators equipped with various forms of sweeps, shovels, disks, and shields he selected or designed. He also revealed the limitations of the method in peat soils, where the spongy soil texture could not resist the lateral forces the blocking set up by cross cultivation. He recognized that the distribution of beet seedlings in the planted row was related to the effectiveness of mechanical cross-blocking.

In 1932 Mervine made calculations based on the laws of probability and chance, for determining the optimum spacing of such cross-blocking devices when the distribution of the seedling stand is known, and a specific final stand is sought. From this analysis he prepared curves for guidance in blocker adjustments and spacings when the germination stand was expressed in terms of inches of row containing seedlings. These curves are widely used in setting up cross-blocking equipment. They were first published in 1933 by Mervine<sup>1</sup> and Skuderna.

Noting the importance of uniform distribution of seedlings in the row for optimum cross-blocking advantages, Mervine next carried out a series of studies of the relative emergence of seedlings from planters (drills) equipped with disk or shoe furrow openers. He concluded the former were superior for whole seed placement. In California, where bed planting of

beets is widely practiced, the use of mechanical cross-blocking equipment was not adaptable. Tests were made with "down the row" blockers, of which two were typical: (1) the Uddenborg<sup>2</sup> and (2) the Dixie<sup>3</sup>. Both of these used rotating members equipped with blades to chop out unwanted seedlings as the machine progressed down the row. These units were found to be reasonably satisfactory in sedimentary soils. Mervine also experi-



A recent model of a commercial sugar beet harvester now in commercial production

<sup>1</sup>Mervine, E. M. and Skuderna, A. W. Cross-Blocking of Sugar Beets by Machine. Leaflet 97 USDA, August, 1933.

<sup>2</sup>Uddenborg, R., inventor, Fort Morgan, Colo.

<sup>3</sup>Dixie Cotton Chopper Co., Dallas, Tex.

mented with crust breakers to encourage better emergence of seedlings in crusted soils. He was unable to develop a unit having universal application, although many types proved beneficial.

These preliminary studies indicated a need for planting equipment which would contribute to a more uniform emergence of seedlings.

McBirney, in 1932, investigated the potential advantages of planting beet seed balls in hills. Rassmann<sup>4</sup> had previously designed and built such a planter. The fluted-feed drills then in use required heavy seeding rates if long gaps in the row were to be avoided. Planting rates of 15 to 20 lb per acre were common. Tests with hill planters were made in 1933, using planters having horizontal and vertical plates. McBirney's tests covering three years of work showed seed-saving possibilities, but resulting stands were imperfect and hill thinning by hand methods often resulted in the loss of all hill seedlings. A study of plate fill was made with respect to plate speed and seedbox fill, showing that plate fill decreased with increase in plate speed and with decrease in box fill. He also observed appreciable crushing and milling of the seed balls, due to warped and poorly set plates. These studies, however, led him to conclude in 1936, that "planters can be devised to plant in close or scattered hills," and that "a high percentage of single seedlings in a germination stand was associated with a uniform distribution of seed in planting, and that single seedlings contributed to good thinning, and reduced time for doing this work." (1936 project report, USDA and California Agricultural Experiment Station.)

McBirney's planter objective at this time was to place a single beet seed ball per lineal inch of planted row. He tried out a planter developed by Palmer<sup>5</sup>, but in actual field trials it failed to produce acceptable results. The experiences with this planter, however, encouraged McBirney to design, construct, and test an entirely new type of planter which he called "the chain-feed, single-seed-ball planter." In this planter a chain with small cups attached was drawn through the seed reservoir to pick up seed balls singly. These were then delivered under controlled conditions to the base of the planter furrow. This clever designing upon the part of McBirney initiated the idea of the single-seed-ball planter and later led to the introduction of the term "precision planting." Walker<sup>6</sup> in September, 1938, reported: "Enough planter work has been completed already to forecast the successful development of a planter which will plant single seeds with controlled spacings."

The harvesting studies conducted during this preliminary research period (1931-38) had to be confined to tests on machines currently available. Mechanical harvesting of sugar beets had been a dream of growers and inventors for many years. Some of the background of this development was reported by Walker<sup>7</sup> in 1942. Tests conducted at the California station were on such machines as the Davis-Thompson, Great Western, and Scott Viner. From these tests, a clearer definition of the harvesting problem was obtained. While more attempts had been made by inventors to ground-top beets mechanically, more real engineering development work had been done on machine toppers such as the Scott Viner. Up to this time harvesting standards were set by hand labor which was plentiful and reasonably dependable. This work was difficult to duplicate by any sort of mechanism. The problem of separating lifted beets from clods was recognized as a vital one, not met by any type of machine then available. The Scott Viner machine more nearly approached grower acceptance than any other. No machine tested up to 1938, however, could meet grower requirements in the California area.

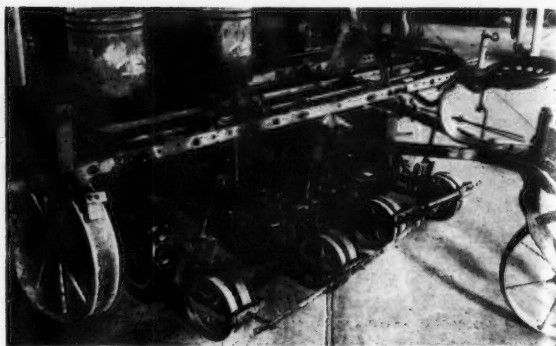
The studies made during this preliminary period (1931-38) may be summarized as follows:

<sup>4</sup>Rassmann Mfg. Co., Minneapolis, Minn.

<sup>5</sup>Palmer, P. S. Spokane, Wash. manufacturer, Cheney Weeder Co., Cheney, Wash.

<sup>6</sup>Walker, H. B. News letter No. 1 U. S. Beet Sugar Association Advisory Committee, September, 12, 1938. Unpublished.

<sup>7</sup>Walker, H. B. Trends in Sugar Beet Machinery Development. Proceedings of the American Society of Sugar Beet Technologists, pp. 243-251, 1942.



An experimental sugar-beet planter used by McBirney in comparing standard commercial types with experimental models. Four different types of planters are mounted on the frame shown.

1 Blocking by cross cultivation and by down-the-row machines was found to be successful in well-distributed seedling stands.

2 Planter development was a primary requisite to obtain a uniformly distributed seedling stand.

3 The problem of separating harvested beets from clods, and an acceptable method for mechanically topping beets were bottlenecks in harvester development, with the former far the more important.

This early research work brought into clearer focus the more important of the problems requiring research attention. These studies attracted the interest and attention of the U. S. Beet Sugar Association, and in 1938 agreements were consummated for that Association to support the investigations through grants. These grants have totaled \$114,000 for the California station. Additional grants were made to other similar institutions, principally the Colorado Agricultural College. Station contributions were also stepped up, and with these added funds it was possible to undertake more vigorous and comprehensive investigations. These are now reported as part two of this resume.

McBirney and Mervine continued work with single-seed-ball planters in California and Colorado. The John Deere Company started its development work on plate and drop improvement of horizontal-plate planters. McBirney's tests made in 1938 comparing his experimental chain-feed-cup, single-seed-ball planter with five commercial types showed superiority over ordinary commercial types, but it was no better than the improved plate type developed by Deere and Co. These developments, however, gave impetus to the idea of single-seed-ball planting, and industry became active in planter development. In October, 1938, Mervine<sup>8</sup> and McBirney prepared a circular summarizing developments in sugar-beet mechanization up to date.

During the winter of 1938-39 Bainer and associates, in an effort to analyze the accuracy of planter performance, introduced the grease-board method of studying seed distribution from sugar beet planters. Grease-covered boards were used to receive the seed balls as these were dropped by the planter mechanism to the shoe. The grease caused the seeds to adhere to the board as delivered by the planter. The board was passed under the shoe at various field speeds, so that a true record of planter performance was obtained. This simple device was an innovation which led ultimately to significant developments in planters and seed processing. The 1939 station reports included this statement: "In addition to producing more uniform stands the single-seed planters also produced from 20 to 30 per cent more single seedlings than with conventional planters." McBirney concluded in 1940: "The single-seed-ball planter has demonstrated its ability to increase the number of single plants, with result that thinning is an easier operation."

<sup>8</sup>Mervine, E. M. and McBirney, S. W. Developments in Mechanical Equipment and Methods in Sugar Beet Production. Circular 488, USDA, October, 1938.

These field and laboratory tests stimulated the practice of modifying conventional plate planters to meet the requirements of single-seed-ball planting, and by 1940 a number of the major implement companies were offering a limited number of improved types for the farm market. Field experiences with these, however, were not altogether satisfactory. Troubles from seed grinding in the metering apparatus were reported and a problem of seedling bunching in the row still remained.

During this dynamic period in planter development, harvesting studies were also under way at the California station. Problems in harvester development were related to the occurrence of doubles and irregular spacings in the row. Bainer, who at this time was interested in both planter and harvester investigations, decided to study the factors influencing seed placement. Knowing that beet seed balls normally contain more than one germ, he conceived the idea of breaking a multiple-germ seed ball into segments. He believed that the segments so produced would provide a seed unit with greater singleness of germ. He had some success in accomplishing this by a "shearing" method, which produced seed units, in number, comparable to the number of original seed-ball units processed.

These segments approached near unity in germs per seed unit, averaging 1.1 germs as compared to 1.9 germs for the original seed. This processing method, incorrectly termed "shearing" in contrast to segmenting, introduced a radical departure from traditional practices. The method used by Bainer was first demonstrated at the California station in May, 1941, and that year he planted one acre with segmented seed. He used seeding rates as low as 3.25 lb per acre, a radical departure from traditional practices. The segmented seed germinated satisfactorily and contributed significantly to increased numbers of single seedlings.

Encouraged by these results, Bainer then developed machinery to process whole seed balls into segments at a rate of 125 lb whole seed per hour. His recoveries were not high and

he advocated upgrading the processed seed through elimination of light ends. Leach, working with Bainer successfully developed methods of seed treatment for this new form of seed.

This pioneer seed-processing work by Bainer and Leach opened up new fields of attack for planter development. The sugar industry immediately recognized the added labor-saving potentialities of using this seed. From the single acre planted in 1941, 10,000 acres were seeded in 1942, and approximately 300,000 acres in 1943. By this time all of the major beet sugar processors in the United States had installed processing equipment patterned after the original designs by Bainer. The demand for improved plate planters adapted for processed seeds exceeded the ability of the manufacturers to supply and many attempts were made to adapt old types of drills in the hope of obtaining the labor benefits accruing from less difficult thinning. These savings in labor were estimated to be approximately 10 man-hrs per acre. Due to war conditions which aggravated

the labor problems, acceptance was no doubt much more rapid than would be normally justified.

Due to the rapid acceptance, Walker<sup>10</sup> in 1942 issued a warning that: "We are still in the cautious phase of 'seed shearing'"; but he also pointed out that "in the planting of seed segments, we are attempting to approach an ideal field stand where even no subsequent thinning may be required. If this ideal is to be approached, it is essential to have seed of known viability approaching perfection in quality; planting equipment capable of distributing the seed in the soil as required for the perfect stand, and a seedbed favorable for the seed and seeding operation."

Seeding rates were now used experimentally as low as 2 lb per acre. Planters of the plate type were designed for two seed sizes, namely, 11/64 to 8/64 in and 10/64 to 6/64 in. Bainer, in 1942, stated "... that the greatest gain made through the use of segmented seed is from light plantings. The use of seed of high viability and vitality is magnified by such light seeding rates." Armer and Bainer developed an aspirator to separate seed segments on a weight basis. This machine, while simple, was effective in raising the percentage of viable seed recovered by approximately 8 per cent. This was another valuable contribution.

By 1943, composite estimates made within the industry showed that 60 per cent of the plantings were already grown from segmented seed. The preseason estimates for 1944 were 80 per cent with estimated savings of 5,000,000 man-hours of labor due to less difficult thinning conditions. This was an achievement of considerable wartime significance.

Even with all of these improvements Bainer observed continued evidence of planter skips. Some planters produced enough skips to make up as much as 25 per cent of the row. Planter plates were restudied and improved, but skips persisted. It was then decided that more analytical studies of seed distribution were needed. Thus planter performance again became a key factor in the utilization of processed seed.

In July, 1943, a conference was called by the Advisory Committee at Greeley, Colo., to discuss planter requirements and seed recovery. At this meeting Carsner<sup>11</sup> pointed out the internal injury to seed by the segmenting process, as well as seed damage from milling in planter plates. This was a significant critical contribution, since it led to a re-examination of seed processing and further improvements in planters. This conference also emphasized the necessity of producing high-quality seed without excessive losses in the processing methods, since seed recovery heretofore had been low.

During the winter of 1943-44, Brooks<sup>12</sup> and others at the California station made extensive statistical analyses of seed metering from plates which had been designed for improved seed cell unloading with reduced seed injury and with greater uniformity of timing in unloading. These studies revealed that these plates were capable of metering and unloading processed seeds accurately. This indicated that seed placement contributing to skips and bunching of the seedlings must take place beyond the point of unloading. These findings led to a study by Bainer of drop tubes from plates. He found that uniformity of drop in relation to final position in the soil could be controlled best by straight, small diameter, smooth, metallic tubes. These, he found, were effective for vertical distances up to 32 in below the plate ejector. This likewise was a significant contribution, which provided the final element for a planter capable of near-precision performance.

With planter elements determined, further attention was next devoted to seed processing to reduce the injuries as reported by Carsner, and to produce uniformly sized and shaped seed units. Leach initiated the idea of using decorticated whole seed, and Bainer developed an experimental decorticating machine. When pregraded whole seed was decorticated and then regraded, the product was like segmented seed. Leach made



Experimental apparatus developed by Bainer and associates for testing precision-type sugar-beet planters. A grease board showing seed distribution is in the foreground

<sup>10</sup>Walker, H. B. Report to Advisory Committee, U. S. Beet Sugar Association, August, 1942. Unpublished.

<sup>11</sup>Carsner, Eubanks. U. S. D. A., Riverside; Calif.

<sup>12</sup>Brooks, F. A.; Baker, G. A.; Lorenzen, Coby; Lewis, H. D. California Agricultural Experiment Station.

studies of field emergence with such seeds, and his data confirmed his earlier hypothesis that through decortication a better shaped, more viable, more uniform, and more easily planted seed unit could be developed. Moreover, these seeds, under actual field environments, produced as many singles per unit of row length as the more roughly processed segmented seed, even though the latter possessed greater singleness of germ. Walker<sup>13</sup> the same year made microscopic measurements of seed units to determine size variations in segmented and decorticated seeds. He reported: "In segmented seed, adhering cork particles sometimes formed more or less translucent knife-like edges to make such units platelike or flat, in contrast to decorticated seed on which no cork adhered."

These studies by Walker confirmed Leach's hypothesis that the smoother, more spherical shape of the decorticated product was advantageous for precision planting.

Bainer then developed decorticating machinery suitable for commercial operations. He concluded: "The quality of seed processed is superior to segmented seed in every respect except the degree of singleness of germ." Seed recovery by these methods was considerably increased, being 50 to 60 per cent of the original for decorticated seed.

Thus seed processing, now almost universally adopted by the industry in the United States, is a product of planter research. Seed segmentation was the initial step in the search for a seed unit with singleness of germ. Injury to seed by this processing method, however, together with low recovery, led to selective methods less violent, and which produced a seed unit with a better shape factor for precision planting. Thus, in this evolution of seed processing, the sized, decorticated seed unit has come to the forefront, and plate-type planters with small smooth drop tubes have been developed to provide uniform seed placement in any desired number per unit of linear travel.

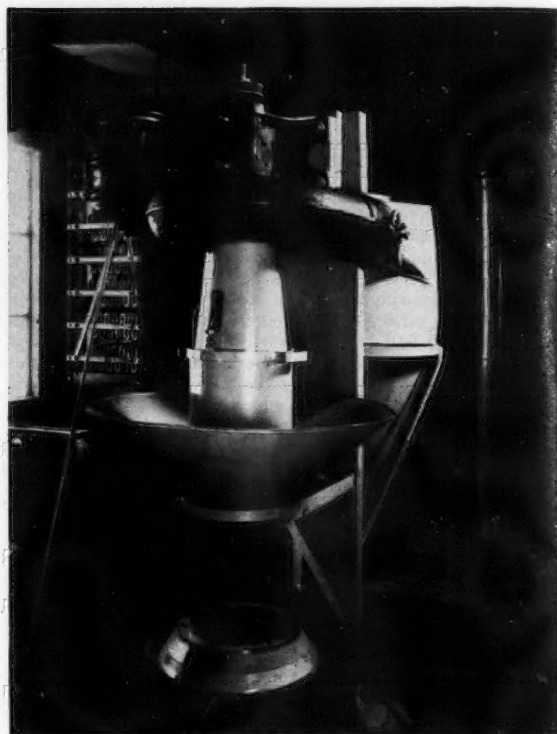
In an effort to attain accuracy of seed placement by planter development, a change in the size and shape factor of the seed was found to be the best way out. With improved seedling stands, spring labor peaks are now smoothed out. Processed seeds are used for 90 per cent or more of the total planted acreage. Commercial precision plate planters of both vertical and horizontal types are generally available through established trade channels.

The harvester studies conducted during the second period of this project included tests of commercial types as were available, but with more funds for investigations, it was possible to conduct original research and development on essential harvester elements. The machines which had been tested up to this time (1938) delivered much trash and dirt with the beets, and the topping quality was unsatisfactory. In general, large beets were topped too high, and small beets were topped too low. None of the machines had facilities to adjust accurately the thickness of the crown cut to the beet diameter.

Powers, at the California station, in his research work initiated in 1938, found there was a more or less linear relation between crown thickness and beet diameter. He likewise found there was a relationship between thickness of crown to be removed and elevation of crown above the soil surface. From these basic analytical studies, he concluded: "There is the possibility of controlling the crown-cut thickness through a gagging mechanism." He accordingly developed an experimental variable-cut topping mechanism. The same year the staff at the California station conducted field tests with the Liberty, Great Western, Zuckermann, and Scott Viner topping units, as well as experimental tests on a rotary toppler designed by the late O. B. Zimmerman.

The following season Powers improved his experimental variable-cut toppler. Early tests showed the field topping by number was 95 per cent acceptable and by weight, 99 per cent acceptable. The publicity given to harvester investigations through subsidized research attracted inventors and a few commercial companies to develop experimental harvesters. In addition to those units mentioned earlier, were the Braden, the Alvors and Devey units, the Pueblo harvester, the Walz machine of Avondale, Colo., which later became the foundation

<sup>13</sup>Walker, H. B. Preliminary Studies of Sizes of Processed Sugar Beet Seed, September, 1945. Unpublished.



An aspirator developed by Bainer and Armer to upgrade sheared and decorticated sugar-beet seeds

unit for the John Deere harvester, the Oliver digger built for American Sugar Co., and others.

Rimple at the California station developed a finger pickup unit with a special plow. Tramontini, at the same station, worked on a unique vibrating lifter; and Armer at the California station also made preliminary studies on beet pickups by spikes. Powers concentrated on his variable-cut toppler, and he conceived the idea of a vibrating knife to sever crowns from beets when topping occurred in place. This he later abandoned. He also conceived a leaf and crown pickup. Armer devised a variable-cut disk toppler based upon the beet-size relationships determined by Powers. This toppler was found to be effective particularly in weedy fields. Out of all of this work the topping problems were brought into clear focus for in-place operations.

With harvesters, the clod problem remained unsolved. Rimple's claw-lifter was ineffective in this regard. The spiked wheel as used by Armer showed little promise, although later a modification of this principle was used successfully by Schmidt and others. The Scott Viner machine as then developed was unacceptable for California conditions. The Tramontini vibrator lifter did not seem to possess reliable operating features, which led to its eventual abandonment, perhaps prematurely. During this rapidly moving formative period, war clouds were also gathering and ready to break. The pressure for some kind of labor-saving equipment for harvesting beets was acutely urgent. Loaders came into use; cross-conveyor harvester units and disk toppers were tried out with some satisfaction. Among those used were the Alvors, Rappetti, Hansen, and Hunt Bros. Armer worked on the hand-sorting-table principle to overcome clod problems, and Armer and Bainer together developed a two-row disk-toppler-digger unit, with hand-sorting belts, and with ultimate delivery of beets direct to trucks. All of these units were cumbersome and relatively expensive to operate, even though some labor was saved. This pressure to do emergency work temporarily diverted the attention of most of the station engineers from basic harvester research.

By 1942 the variable-cut topper developed by Powers was released for non-exclusive manufacture to selected implement companies. Powers devised a leaf windrower to go with his topper and did preliminary work on a helical plow for lifting beets, the objective of which was to reduce clod sizes. He experimented with a chain-hook elevator to engage pretopped lifted beets in order to separate or drain clods from harvested beets. In spite of all this resourceful and basic work on the part of Powers, station reports that year stated: "Our harvesting operations beyond topping have not attained grower acceptance."

Industry was very active during this period. The John Deere Co. placed approximately fifteen of its experimental harvesters in the field in 1942, and programmed 100 for the following year. The Allis-Chalmers Mfg. Co. did experimental work in California, as did also the Sawtooth Co. The International Harvester Co. adopted the variable-cut, disk-type topper as developed earlier by Armer, and the Blackwelder Co. was building a harvester after designs by Schmidt, Jongeneel and associates. The year 1943 marked the beginning of the successful commercialization of sugar-beet harvesters, and grower acceptance had started.

Powers in his experimental designs at the California station was successfully using flat, thin knives for topping, as was also the John Deere Co. Disk toppers were used successfully by International Harvester Co., and Marbeet (Blackwelder) was successful with machine topping, as was also Scott-Urschel. In September, 1944, Walker reported to the Advisory Committee of the U. S. Beet Sugar Association, in part as follows: "The work on harvesting machinery has continued with varying degrees of success. . . . Machines now commercially available are operating in the field with sufficient success to keep them going; but these are also sufficiently faulty to create a desire for improvements. Topping, top recovery, and removal of roots without excessive dirt and breakage, appear to be the bottlenecks for a more satisfactory product at the dumps (factory). The problems of these commercial units have caused us (California station) to direct our studies toward obtaining a better harvested product."

Powers continued diligently his efforts during the 1945-47 seasons in perfecting a single-row, tractor-mounted harvester unit, using his own designs of the variable-cut topper, helical plow, chain-lift conveyor, cleaning elevator, and overhead bin. With this unit he was able in 1947 to obtain 96 per cent recovery of beets with excellent topping quality and relatively low dirt tare in soils ranging from dry and hard to moist and sticky. Under good operating conditions for harvesting in flat-planted, 20-in row-spaced beets, yielding 20 tons and upwards per acre, the rate of recovery with one operator was 6 to 8 tons per hour. This single-row unit represents nine years of intensive development work at the California station upon the part of J. B. Powers and associates; and it closely approaches the broad objectives for mechanically harvesting sugar beets as set up in the original project statement. In the meantime, the

farm implement industry has provided new types of harvesters which in 1947 harvested over 65 per cent of California's sugar beets. It is estimated<sup>14</sup> that nearly 4000 harvester units were in operation in the nation in 1947, to harvest 30 per cent of the nation's sugar beet crop. Double that number of harvesters is predicted for the 1948 season.

Thus 16 years of research and technological effort, nine years of which were conducted intensively under the handicaps of World War II, have yielded commendable achievements of benefit to the sugar beet industry. One must remember, however, that during these years of productive research, a sympathetic and anxious industry, functioning through its Advisory Committee, and an eager helpful, even tolerant, farm implement industry stood by at all times to lend aid and assistance to carry into immediate practice the findings of this and their own research. To these faithful and helpful co-operators much credit is due. It is my belief that the research investment of a quarter of a million dollars has been fully justified. Furthermore, I hope the project I have had the honor to report will serve as an example for similar cooperative investigations involving agricultural engineering guidance and direction. Although the author was the only person connected with the project continuously for the full 16 years, the credit for actual achievement belongs to all of the 25 competent state and federal workers as well as the representatives of related industries.

<sup>14</sup>Smith, Dudley. Sugar Beet Mechanization and Implications for Puerto Rico. Association of Sugar Producers of Puerto Rico, March, 1948.

#### APPENDIX A. NAMES AND TITLES OF RESEARCH WORKERS, CALIFORNIA AGRICULTURAL EXPERIMENT STATION, SUGAR BEET MACHINERY INVESTIGATIONS, 1931-47

- \* Armer, Austin A., associate in the experiment station, University of California, and assistant agricultural engineer, USDA.
- \* Bainer, Roy, agricultural engineer in the experiment station, University of California.
- Baker, George A., assistant statistician in the experiment station, University of California.
- Barbee, C. E., associate in the experiment station, University of California.
- Bice, Richard A., field engineer, (Colo.) experiment station, University of California.
- \* Brooks, F. A., agricultural engineer in the experiment station, University of California.
- Hall, F. G., mechanic, University of California.
- Leach, Lyle, plant pathologist in the experiment station, University of California.
- Lewis, H. D., associate in the experiment station, University of California.
- \* Lorenzen, Coby, Jr., assistant agricultural engineer in the experiment station, University of California.
- Lory, Fred, Jr., mechanic, University of California.
- \* McBirney, S. W., agricultural engineer, U. S. Dept. of Agriculture.



Left: Loading sugar beets in prewar days. Stoop labor was a characteristic of sugar beet harvesting previous to the development of mechanical harvesters • Right: The experimental sugar beet harvester developed by Powers. This harvester has a variable-cut topper, helical plow, cleaner for the lifted beets, and an overhead bin

- \* Mervine, E. M., agricultural engineer, U. S. Department of Agriculture (Deceased).  
 \* Powers, J. B., associate agricultural engineer in the experiment station, University of California.  
 Rimple, Ed., development engineer in the experiment station, University of California.  
 Robbins, W. W., botanist in the experiment station, University of California.

- Symens, P., mechanic, University of California.  
 Tramontini, Vernon N., associate in the experiment station, University of California.  
 \* Walker, H. B., agricultural engineer in the experiment station, University of California.  
 \* Zimmerman, O. B., associate in the experiment station, University of California (Deceased).

\* Indicates members of ASAE.

## Electric Power as a Tool in Farm Drainage

By Virgil Marvin

**H**OW DO farmers drain their farm lands under conditions of approximately 33 in of precipitation when the tile lines are below lake level?

This complex drainage condition occurs in a large part of Jerusalem Township, Lucas County, Ohio. The area is east of Toledo, Ohio, along the southwest shore of Lake Erie. The land surface is in general a level plain, sloping gently northeastward to Lake Erie about 5 ft to the mile, or approximately an 0.095 per cent slope. A large amount of acreage has been reclaimed from marshland by a system of dikes, drainage canals, and pumps. The term "pump farms" is sometimes applied to the area.

The use of underdrains for removal of excess water is limited only by the need, ability of soil to respond and give a fair return on investment, and an adequate outlet for the drains.

The soil type occurring most extensively in the area is Toledo silty clay. The surface soil is dark grayish-brown to grayish-black silty clay. Subsurface soil down to about 16 in is dull-gray silty clay somewhat mottled. It is sticky and plastic when wet.

Due to the level topography, the surface drainage and internal drainage is poor. With proper drainage and good soil management the soil is very productive.

As a result of this poor natural drainage condition, it becomes necessary to manufacture drainage. In most cases open-

type drainage ditches are constructed on the farms to provide tile outlets. The ditches are carried along until they meet a man-made canal. As the ditches are below the canal level, it is then necessary to raise the water from the ditch into the canal by mechanical means. There are, however, some installations in which the lateral lines and submains outlet into a large main which in turn discharges into a large sump. The water is then pumped into the canal.

The power pump most used is a vertical, propeller-type pump designed to handle large quantities of water at low heads. Most of the pumps have been made locally. The pumps are designated as to size by the diameter in inches of the discharge. With this type of pump the horsepower requirements are not seriously affected by fluctuations in head. They are usually driven at a speed of 800 to 1,000 rpm.

Farmers have been pumping this area for some time, and it is only within the last several years that some have been replacing large tractor-operated units with smaller electric-powered units of 3 to 7½ hp.

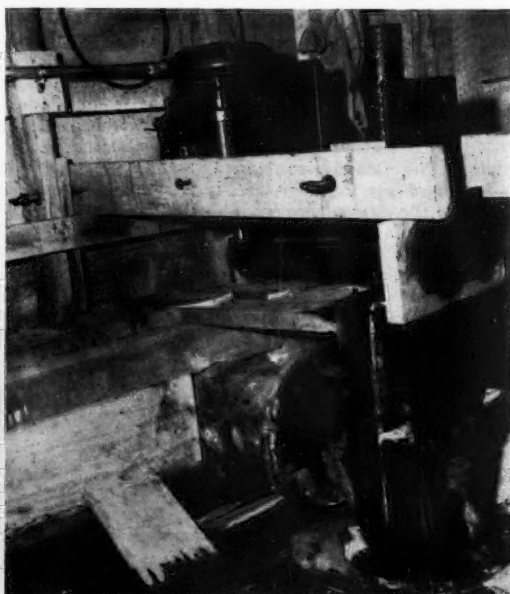
A survey of farmers using 3 to 7½ hp electric-driven pumps shows the drainage operation to be entirely satisfactory. The survey also showed the following conclusions advanced by those using the smaller electric-powered pumps:

- 1 Pumping operation can be carried on when it is raining
- 2 No attendant required at pump during operation
- 3 Tractor and man released for other jobs
- 4 This method can be and is adapted to drain depression areas in fields where affected area has no tile outlet. The method is to outlet the tile into a sump and pump from the sump.

This paper was prepared expressly for AGRICULTURAL ENGINEERING.

Virgil Marvin is field supervisor, farm power department, The Toledo Edison Co.

**AUTHOR'S ACKNOWLEDGMENT:** The author acknowledges the work of Charles Hootman and Jess Benson in adapting 3 to 7.5-hp electric-driven pumps to farm drainage.



A view of the drainage ditch and drainage canal (left) on the Pete Wilhelm Farm, Yondota Road, Lucas County, Ohio. The drainage ditch at right provides the outlet for 150 acres of tiled land. Water is pumped from the drainage ditch into the canal by a 7½-hp, 12-in pump (right), the estimated capacity of which is 2600 gpm. Crops now grown on this reclaimed land are tomatoes, sugar beets, cucumbers, and corn

# Precast Concrete Septic Tanks

By W. G. Kaiser

FELLOW A.S.A.E.

**S**OME striking facts concerning recent development in the design and use of precast concrete septic tanks were revealed in the results of a questionnaire sent to manufacturers early this year. In this survey questionnaires were sent to 210 manufacturers in different parts of the country. Data were requested on the size and type of tank being made, method of reinforcement, and similar information.

Summaries of the first 83 questionnaires returned by manufacturers disclosed that they had made a total of 50,804 tanks in 1947. Twenty-one of this group made more than 1,000 tanks each in 1947. Fourteen manufacturers made between 500 and 1,000 tanks apiece during the year. Seventeen manufacturers made from 300 to 500 tanks each. Only eleven of the 83 manufacturers reporting made less than 100 tanks each last year. It is significant that the majority of precast concrete tanks were made by large producers. In large plants it is readily possible to provide the facilities for manufacturing tanks efficiently. In some of the larger plants the manufacture is on an assembly-line basis. Practically all operations are mechanized and are under close control. This leads to a product of uniform quality.

Septic tank sizes are usually rated in terms of their liquid capacity in gallons. At the time this paper was written, 90 manufacturers had furnished data on the capacities of their tanks. Fifty-seven are making tanks of 500-gal capacity or larger. Sixteen are making tanks of over 700-gal capacity. Often manufacturers produce tanks in several sizes. However, the trend is to discontinue the manufacture of tanks of less than 500-gal working capacity, which is quite generally regarded as the minimum for a one-family tank unit.

Precast septic tanks can be placed in three groups with respect to shape: vertical cylinder, horizontal cylinder, and rectangular box. Many of the earlier precast tanks were cylindrical in shape, doubtless because molds used in casting large concrete pipe could readily be adapted to the manufacture of precast tanks. The trend in the last few years is definitely toward the rectangular tank, conforming in capacity and design to recommendations of the Joint Committee

on Rural Sanitation\*. Such tanks are approved by most health authorities. The cylindrical-shaped tank is not as yet approved by some authorities, largely because no data are available with respect to their performance in service. However, it can be said that when of adequate capacity and of proper design and installation they are performing satisfactorily.

In general, data are lacking which might be used as the basis for approving or disapproving of commercial tanks. However, some much needed research in this field is now being conducted cooperatively by the U. S. Public Health Service and the Housing and Home Finance Agency. These tests are designed to determine the efficiency of sedimentation, adequacy of sludge storage, capacity, size, shape, durability of materials, and other characteristics of commercial tanks.

As previously stated, many of the earlier precast concrete septic tanks were cylindrical in shape. Several sections were often hooked up in a battery to obtain the required tank capacity. The tank depth did not permit much sludge storage and, unless cleaned out frequently, clogging sometimes resulted. The use of relatively small-size units can be attributed to the desire to keep them of such size and weight that they could be handled manually. With the development of facilities for handling the units mechanically, both in the plant and on the job site, the trend has been toward the large one-compartment unit. Some of these are made in sections or rings which can be superimposed, one on the other, to form the completed cylinder. This necessitated the sealing of the joints as the sections were set. To avoid this operation the walls of cylindrical tanks are now made in one piece. Often the concrete bottom is cast integrally with the walls. Lids or covers for such tanks are usually cast separately.

The horizontal cylinder type of tank consists of a large cylinder laid on its side. A variation of this type is a tank with a rectangular top and a rectangular bottom and then rounding out like a barrel in the midsection.

Rectangular tanks are made both in one piece or in a number of pieces designed to fit together snugly. A type of rectangular tank quite widely used in southeastern states consisted of a number of slabs with interlocking features designed to make the slabs fit tightly together and to tie the end slabs to the side slabs. The advantage of this type of tank is that the sections are small (Continued on page 433)

This paper was presented at the annual meeting of the American Society of Agricultural Engineers at Portland, Ore., June, 1948, as a contribution of the Farm Structures Division.

W. G. KAISER is manager, farm bureau, Portland Cement Assn., 33 W. Grand Ave., Chicago 10, Ill. (Mr. Kaiser is the 1946 recipient of the Cyrus Hall McCormick Gold Medal awarded by ASAE.)

\* "Individual Sewage Disposal Systems" (Recommendations of the Joint Committee on Rural Sanitation). Reprint No. 2461, U. S. Public Health Service. (For sale by Superintendent of Documents, Government Printing Office, Washington 25, D. C.—10 cents per copy.)



Left: A steel form set up for casting a concrete septic tank with rounded ends • Center: A power take-off from the truck engine makes short work of the job of loading this precast concrete septic tank on the truck for delivery to the job site. The mechanical hoist is also used for lowering the tank into the hole • Right: A rectangular precast tank has been lowered into the hole in this picture, and the precast lid sections are being lowered into position

# A National Cooperative Plumbing Program

By Earl L. Arnold

MEMBER A.S.A.E.

**W** E SOMETIMES hear the question: "Just what business does the Rural Electrification Administration have in the plumbing field anyway?" The answer to this question not only tells why we are interested in farm plumbing but also gives a key to the nature of the REA program.

The REA is a government money-lending agency. It does not make grants of money for any purpose. It builds no electric lines. It buys no electrical or plumbing equipment, and it makes no electrical or plumbing installations.

The agency is known primarily because of the money that it lends for the construction of rural electric distribution systems. The fact that it also lends money for individual consumer facilities is not so well known.

The loans for consumer facilities are entirely separate and distinct from the loans for line construction. They are authorized by a different section of the Rural Electrification Act. The most pertinent sentence in the Act in this respect reads as follows: "The Administrator is authorized and empowered, from the sums hereinbefore authorized, to make loans for the purpose of financing the wiring of the premises of persons in rural areas and the acquisition and installation of electrical and plumbing appliances and equipment."

The consumer facility loans are made to the same organizations that borrow for line construction. For the most part, these organizations are locally owned and locally managed cooperatives. These cooperatives in turn make loans to their individual members, and the cooperatives, rather than the members individually, are responsible for repayment to the government. The government loan is usually in a lump sum sufficient for many individual consumer loans.

In addition to the specific authorization to finance the acquisition and installation of plumbing equipment, the estimates of repayment on which the REA loans for rural electric line construction are based assume a more or less normal growth in the use of electricity by the consumers. Electric water pumps are among the most universally applicable electric appliances. The probable eventual saturation of them is high. Electric water heaters are relatively large users of electricity, but under the rates of most of the cooperatives their operating cost compares favorably with the cost of heating water by other means. When we consider these facts, it becomes apparent that the use of electric water systems is a significant factor in the ultimate repayment of the line construction loans.

A third important factor is that the repayment of an REA loan depends on the borrower remaining in a financially sound condition. In a cooperative, this depends on member support, and active member support can be expected only when a cooperative is furnishing valuable services to its members. Help and guidance with their water systems and plumbing is a valuable service that the cooperative can give.

At this point it might be well to point out that the REA plumbing program is only one phase of an over-all power-use program. From the foregoing, it can be understood that all of the points that have been mentioned can be applied to other uses of electricity.

A power-use program and a load-building program are not different names for the same thing. A power-use program is aimed at helping consumers make the best use of electricity consistent with their own needs regardless of what this does to the amount of electricity consumed. In times of power shortage, it could even be used to help consumers adapt their use of electrical equipment to the limited power that is available.

This paper was presented at the annual meeting of the American Society of Agricultural Engineers at Portland, Ore., June, 1948, as a contribution of the Farm Structures Division.

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able. A load-building program is aimed at increasing the consumption of electricity. The REA does not have a load-building program, and, except in very rare instances, does not recommend such programs to its borrowers.

Like any other banking institution the REA recommends policies and procedures to its borrowers to insure the security of the loans. As a part of the U. S. Department of Agriculture it is interested in seeing that its facilities are used to bring the greatest possible benefit to the rural people of the nation.

The REA power-use program, including the plumbing program, is significant to rural people only indirectly. A farmer receives his direct benefit from the plumbing program when the cooperative to which he belongs carries out a power-use plumbing program of its own. The program of the REA, as a government agency, is one of advice and help to the cooperatives.

There are now about 1,000 rural electric cooperatives in the country serving an average of about 2,000 consumers each. We have no accurate records of numbers of these consumers with water systems and plumbing, but our best guess from such data as we do have is that somewhere around 25 per cent have electric water systems and about 12 per cent have bathrooms. The best information that we have indicates that about 40 per cent of the cooperatives are considering organizing specific plumbing programs. At present, about 12 to 15 cooperatives scattered throughout the country have these programs under way. The oldest of these postwar programs started about 18 months ago.

Since each cooperative organizes and conducts its own programs, we cannot tell you what the program on any particular cooperative will be or how it will be carried out. But we can tell you what our recommendations are, and we know how the few programs that are under way are being handled. From these facts we can give you an idea of what to expect.

First, and foremost, it is the policy of the REA to discourage its borrowers from merchandising equipment or making installations for their consumers. Each of them has a full-time job in the merchandising of electricity, and in programs that are closely associated with this primary function. This policy of the agency is sometimes overlooked in discussions of its programs and has resulted in misunderstanding. Some of these misinterpretations have been widely published and in a few cases have served as a base for still other interpretations which were still less accurate.

But maybe some of you are saying, "I know of a rural electric cooperative that is merchandising equipment." In this respect, remember that these cooperatives are private business enterprises. Except for a very few conditions that are written into the loan contracts, the REA exercises no positive control over them. Only a very few of them are merchandising, and the number that will merchandise plumbing equipment or that will make plumbing installations will be negligible in the whole number. It is probably safe to say that any distributor who adequately serves the territory will automatically eliminate any possibility of the electric cooperative entering into competition with him. Likewise, any plumbers who really serve the cooperative's members will get nothing but wholehearted cooperation from the cooperative.

The expected result where existing equipment distribution is not adequate is group purchasing, not merchandising, by the cooperative. In some of these group-purchasing activities the cooperatives may serve as clearinghouses where the members assemble their orders and from which the orders are sent to suppliers. In other cases, the entire transactions may be carried on with nothing more than advice from the cooperatives.

In places where lack of skilled workers is a bottleneck, the cooperatives may take the lead in seeing that people are trained to do the necessary work.

A few large distributors of plumbing equipment have become sufficiently interested in the plumbing programs of the

rural electric cooperatives that they are developing procedures for close working relations. One of these companies has a man whose full-time job is coordinating the activities of his company with the REA program. The outstanding thing that seems to be coming out of this is the establishing of rural dealers. These dealers are being located so as to serve the membership of cooperatives which have plumbing programs. Sometimes there are four or five of these rural dealers in the territory of one cooperative. The rural dealers of at least one of these companies are forbidden by their franchise from working in town. Rural dealers are required to furnish full installation and service facilities as well as sales facilities. Each has at least one skilled plumber either in his employ or working closely with him. While materials are scarce, these companies are making special allocations to these rural dealers.

No two cooperatives will conduct their programs just alike, but, for the most part, their activities will consist of advising and helping their members to plan their installations correctly, to get the equipment best adapted to their needs, and to have it installed properly. They will help their members locate sources of equipment and suitable workmen for making the installations. The wide ramifications of this will be realized. It involves advice on wells, well protection, bathroom location and layout, kitchen arrangement, septic tanks, garden watering, watering livestock, and the many other farm uses of water and the sanitary facilities that go with them.

In most cases, the local health officials will be closely tied in and will be an integral part of the programs. All of the help available through the schools and the agricultural extension service will be needed and used.

But even with all of these sources of help the cooperatives still have a serious problem of personnel. During the past year and a half the number of cooperatives that have employed personnel for power-use work has increased tremendously. Upward of two hundred now have such employees and more would have them if they could find suitable persons for the jobs. Most of them want either home economists or agricultural engineers, or both. Within the next three or four years these cooperatives may try to employ three or four hundred agricultural engineers.

#### THE COOPERATIVE'S ELECTRIFICATION ADVISER

The titles being given these power-use workers vary from cooperative to cooperative. For the sake of uniformity, those of us in REA call them electrification advisers. The cooperative's electrification adviser is the person who will be responsible for the cooperative's plumbing program. He will organize it and carry it out under the general supervision of the manager.

As has been mentioned previously, the REA's part is one of advice and assistance to the cooperatives. The REA Applications and Loans Division had specific responsibility for the power-use program. There are agricultural engineers on the field staff of this division, and they have the primary responsibility for helping the individual cooperatives set up their plumbing programs. But at present there are less than ten field agricultural engineers in the organization, and the plumbing program is only one phase of the power-use program.

Let us suppose that, within the next four or five years, 400 cooperatives will have organized plumbing programs. If each has an average membership of 2,000 and only 12 per cent of the members have bathrooms, these programs will involve a potential of about 700,000 installations.

It is evident that the engineering help that can be supplied by REA will not amount to a drop in the bucket; and yet, we all know that every one of these installations will have to be engineered by someone.

If we look at an individual cooperative, we have a similar picture. Let us assume that there are 2,000 members and 12 per cent of these have bathrooms. This leaves over 1,700 potential installations. Even if the electrification adviser is the best qualified engineer for this work that is available, it is obvious that he could not do the job even if he did nothing else.

These figures are based on potentials. It is correct to say that not nearly all of the potentials will be actual installations. Then we are assuming that 400 cooperatives will have organized programs. If you make any reasonable modification

in these figures that you care to, they still present a tremendous agricultural engineering job. The REA is not and will not be in a position to do it. The individual cooperatives will not be in a position to do it either, although by demonstrations, group meetings, various types of publicity and other devices, they will provide a great deal of help.

Much of the actual engineering work will be done by farmers themselves, and by local tradesmen. There will be mistakes, but we are hoping that the engineering information put out by colleges, schools, and health agencies, and the help that agricultural engineers with commercial organizations can give through their regular trade channels, will keep these mistakes to a minimum. We are particularly anxious that each installation meet minimum health standards and minimum standards for adequacy.

## Precast Concrete Septic Tanks

(Continued from page 431)

and can be handled easily. Molds or forms can be made of wood or metal. The disadvantages are that the joints, if not properly sealed, will permit leakage and that additional care must be exercised to insure a first-class construction on the job. Some of the manufacturers which originally made the sectional type of rectangular precast tanks have changed over to the one-piece tank.

In modern precast concrete septic tanks the design of the inlets, outlets, and baffles is usually such as to conform with local or state health regulations. Some regulations require baffles to protect both the inlet and the outlet, whereas some require baffles only at the outlet. Baffles are of various types. In cylinder-type tanks they are cast integrally with the wall or are cast separately and inserted in vertical slots cast in the wall. In rectangular tanks the baffles are usually cast separately and inserted in slots provided in the side walls. In some states tee-shaped sewer pipe, which deliver the incoming and take off the outgoing effluent a foot or more below the scum line, are used in place of other types of baffles. Sometimes holes of about 8-in diameter are cast in the cover directly over the inlet and over the outlet. Small concrete covers are placed over these openings. The purpose of the openings is to permit inspection of the inlets and outlets by removing the two small covers. In rectangular septic tanks the cover is usually cast in several pieces for greater ease in handling.

Precast tanks are usually delivered to the job in trucks equipped with mechanical hoist to load the tanks on the truck at the plant and lower them into the hole on the job. Most of the modern plants are equipped with such trucks and their listed prices of tanks include delivery to the job. Manufacturers realize it is their responsibility to see that their tanks are properly installed. Poor or improper installation would soon result in unsatisfactory service regardless of the excellence and adequacy of the tank. Precast tanks, cast in one piece, weigh around 2 tons each for the 500-gal capacity size. Tank walls and floors will average around 3 in thick in most types. Wall and floor reinforcement consists for the most part of steel mesh formed into a rectangular or cylindrical basket. Concrete mixture is at the rate of 5 gal of water per sack of cement, with coarse aggregate up to  $\frac{3}{4}$  in in size. Mixtures are kept quite stiff and are settled into molds by vibration. Under efficient production methods one tank can be cast per day in one set of molds.

The recent rapid increase in the use of precast concrete septic tanks can be attributed to the preference for ready-made, ready-to-use products. Such tanks can be put into service shortly after being connected with the sewer lines from the house and to the disposal field. The purchaser knows exactly what the tank will cost installed, and he is relieved of the details of buying materials for forms, fabricating forms, purchasing concreting materials and employing labor for building a cast-in-place job. The increased demand for precast units can also be attributed to the fact that manufacturers realize the responsibility of producing a tank acceptable to health authorities and which will render satisfactory service.

# Soil Fumigation

By Walter Carter

**I**T HAS long been recognized that as agricultural soils became older and cultivation more extensive, there was need for some soil amendment to offset the growing complex of pathogenic organisms which develop. In places where fertility can be maintained by the addition of organic matter in large quantities, the need has not been so great as in other areas where soils are low in organic matter or where the agricultural practice did not include the use of organic fertilizers. Even in some old and well-established agricultural areas, however, it has been impossible to grow many crops, except occasionally in a long rotation. Examples of this can be found in Great Britain, where in many places potatoes can be grown only one in seven years on the same land, or in Utah where sugar beets require a four or five-year rotation with other crops. In tropical or subtropical areas, where the maintenance of the organic content of the soil is an extremely difficult matter, the need for a soil amender is in many places an acute one. Sometimes the pathogenic soil complex appears to be dominated by specific organisms, as, for example, nematodes, wireworms, or specific fungi or bacteria. It is my opinion, however, that even in these cases the final result can best be understood by considering the effect of the soil amendment on the soil complex as a whole. This should perhaps be qualified in one respect. If a specific organism is known to dominate the complex as far as damage to plants is concerned, then the fumigant most specific for that organism should be used.

**Materials Used.** The literature on this subject is very extensive and practically all the chemicals, both dry and liquid, which are known to have some biocidal property have been tried. Of the volatile compounds carbon bisulphide is probably the oldest and still finds many uses in this field. Objections to it are its extreme inflammability and the large volume necessary to achieve results. Chloropicrin came into use following the first world war. This material is one of the most powerful fumigants known. Being a tear gas it is extremely difficult to handle and might seriously affect the lungs of workers constantly using it. The principal objection to its use, however, has been its high cost. But even with this disadvantage it still finds considerable use in highly specialized situations, such as greenhouse and nursery beds, and to a limited extent in the highly specialized agriculture in the Hawaiian Islands. Possibilities of using a soil fumigant under field conditions in general agriculture, however, were brought about by the discovery that a mixture of 1.3 dichloropropene and 1.2 dichloropropane could be produced cheaply as a by-product of the manufacture of allyl chloride, and that this mixture was an extremely efficient soil fumigant. This finding which was first reported from the Pineapple Research Institute in Honolulu, has since been confirmed by many workers both on the United States mainland and other countries. Its success has greatly stimulated the work on soil fumigants in general, with the result that already other promising materials are available for use. The most recent of these is ethylene dibromide, which in some areas, particularly where wireworms are prevalent, has proved to be a keen competitor of the mixture of dichloropropene and dichloropropane.

**Methods of Testing.** There is some difference of opinion with regard to the best method of testing soil fumigants. One of these is to use small quantities of soil, which are kept in tightly sealed containers during the period of fumigation. Test plants are then grown in this soil and compared with check plants. At first sight this method appears to be a very

exact one, but actually the results of such experiments are very difficult to interpret in terms that the grower can use. The most practical method for testing fumigants is to use field plots with suitable replications in soil where the need for fumigation has been indicated. Crop yields can therefore be used as a final criterion. This is admittedly an empirical approach and the basic considerations must not be lost sight of. First of these is the question of dispersal through soil. It is a difficult thing to measure and the problem calls for cooperation of soil physicist and biologist.

Second is the retention of the fumigant gasses and their breakdown products in the soil, because the answer to this question sometimes determines the practicability of a fumigant for a given crop in a given location.

Another basic consideration is the effect of the fumigant on the soil microflora and fauna. This is a problem which is a challenge to the soil microbiologist for it must never be lost sight of that the fumigation of soil probably completely changes the relative populations of soil microorganisms. There is another and even more subtle problem in soil fumigation that so far eludes even a reasonable hypothesis and that is the explanation for the long carry-over effect on plant growth that fumigation has. When the effects of a treatment before planting are greater the farther removed in time the treatment becomes, then it is clear that some factor other than the temporary removal of soil microorganisms is responsible. There are experimental plots on the Pineapple Research Institute grounds at the present time which were fumigated almost three years ago and the difference between fumigated and untreated plots is greater now than it has been since the experiment started. Finally there is the extremely practical but basic problem of getting the fumigant into the soil.

It would no doubt be possible for the American chemical industry to produce 100,000 tons of a soil fumigant without great difficulty. But getting this quantity into the soil in an efficient manner is another matter.

The accompanying contribution by Robert R. Owen to this problem is a timely and valuable one.

## Elevator Builds Trade by Treating Seed Grain

**T**O BUILD trade for an elevator, you've got to give service, and we think seed treating is a practical service for grain-elevator operators," says G. H. Homme, manager of the Farmers Elevator Co. at Kerkhoven, Minn. "The farmer gets better crops, and we get better quality grain. It's hard to dock your best customer for inferior grains—that's why we set up a seed-treating service."

In 1946 the elevator company treated more than 80,000 bu of seed for its 3,200 patrons, and this was double the amount of seed treated in 1940. That custom treating of seed, begun in that territory in 1939, is steadily increasing is further evidenced by the 1947 total of more than 105,000 bu for nearly 3,500 patrons.

Use of 4,800 lb of a chemical seed disinfectant on about 105,000 bu of grain and flax seed by the Farmers Elevator Co. brought almost a third of a million dollars more cash to the farmers of that community than might have been expected from untreated seed. And this at a cost to the farmers of a fraction more than one cent for each three dollars extra money received from the increase in yield.

The elevator company recently issued a statement saying a total of 105,688 bu of seed grain and flax were treated in 1947 with a seed disinfectant at an average rate of 1 lb to 22 bu of seed. This included 70,620 bu of oats, 3,608 bu of wheat, 11,016 bu of barley, and 20,444 bu of flax.

This treated seed was planted on 59,058 acres and produced a harvest of 2,365,249 bu, a yield estimated by the company at nearly 200,000 bu over what growers normally would expect to grow with untreated seed.—*Du Pont Agricultural News Letter*, September-October, 1948.

This paper is intended as a "foreword" to the one on the opposite page by Robert R. Owen.

WALTER CARTER is head of the department of entomology, Pineapple Research Institute of Hawaii.

(EDITOR'S NOTE: In submitting the accompanying paper to us, Rene Guillou writes: "Dr. Carter modestly omits to mention that the value of DD as a soil fumigant was his discovery. I understand that he is regarded as the leading present authority in this field.")

# Equipment for Applying Soil Fumigants

By Robert R. Owen

MEMBER A.S.A.E.

**I**N MANY respects the application of soil fumigants by machine is in its infancy. The number of pieces of equipment tried here in Hawaii is small in comparison to the number of possibilities open, and we have therefore developed no experts on the subject. Of the hundreds of pumps which might be successful in this field, very few have been tried and very few of their manufacturers are aware of the problems involved. An inquiry to one of these pump manufacturers, stating the type fumigant which is to be used, usually draws a response asking what the chemical composition is, what the temperature and pressure will be, and other pertinent questions.

The types of fumigant currently in use here are DD, chloripicrin, and ethylene dibromide. Except from the standpoint of corrosion, the application problems are much the same. The largest users of soil fumigants in the territory at present are the pineapple plantations. While their problems are in most cases the same as those of a smaller grower, the size of their operation makes more expensive equipment economically possible. To illustrate that point, I'll briefly cover the equipment we use on our plantation, where soil fumigation has been a regular practice since 1937. Since that date the company has fumigated in the vicinity of 30,000 acres and has learned a great deal by trial and error.

Our fumigant machinery developed by C. V. Morine, plantation agricultural engineer, is mounted on our mulch paper laying machines. Fumigant supply tanks of sufficient volume to permit operation for 4 to 5 hr are mounted on the tractor high enough to provide a gravity flow of fumigant to the injector pump. Experience has shown that this results in a more uniform application rate. The cylindrical tanks are mounted with the axis at a slight angle to the horizontal and a sump with a drain is provided at the lower end where sludge which is often present in the fumigant, is collected and drained off. This sludge condition is most pronounced when the fumigant has been in storage from one planting season to the next. Prior to making this provision for keeping sludge out of the system, we were often troubled by clogged lines, malfunctioning of the valves, etc.

Between the main supply tanks and the pump we have installed a measuring tank with a glass sight gage. This sight gage has markings to permit the operating crews to make an on the spot check of application rates by closing the main supply tank valve and pumping from the measuring tank. The standard 600-ft roll of mulching paper represents an

area of 0.069 acres of coverage and for various application rates the sight gage can be marked for the area represented by one roll of mulch paper.

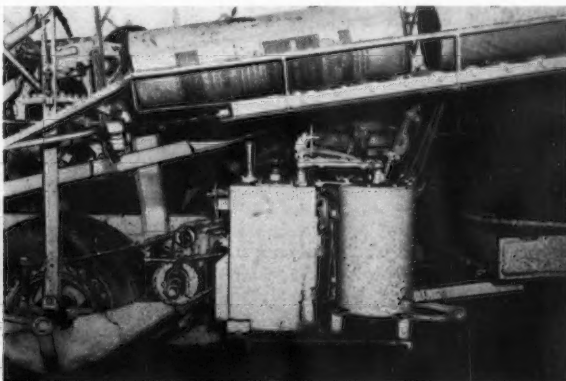
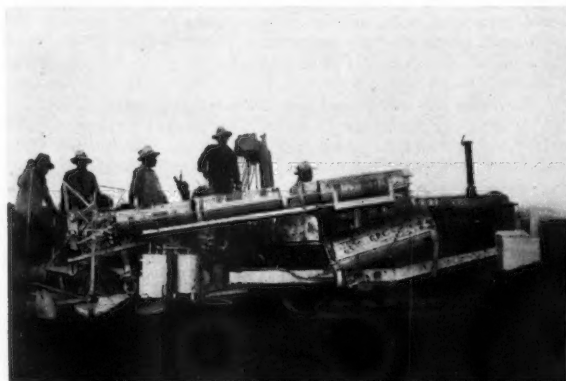
The increased yields due to fumigation are such that any area which is inadvertently skipped in the fumigation process results in a real financial loss. Therefore, the operating crews must have positive assurance at all times that the system is working. Pump failure or clogged tips must be evident to the crew immediately so that the machine can be stopped and necessary repairs completed. A failure which goes unnoticed for 4 or 5 acres results in a direct financial loss sufficient to pay for a fumigating system. To provide this assurance of operation, the fumigant pump is equipped with a vertical sight gage on the outlet side. At the base of the gage a ball rests in a seat. When the pump is in operation, the ball is held off the seat, or, in the case of reciprocating pumps, it raises and lowers with each stroke of the pump. The line leading to each injector tip is equipped with a sight gage so that failure of the pump or a clogged tip results in the ball remaining on its seat.

By means of this sight gage the effect of clogged tips has been minimized. To reduce the causes of clogged tips we have installed spring-loaded check valves at the injector tips, thus building up pressure in the system. With the fumigant leaving the tip under pressure, the soil and trash which might clog the tip are forced away. In systems where gravity flow of fumigant through the tip is used, tip clogging is usually a nuisance. These spring-loaded check valves serve several other purposes. The pump which we use has a more satisfactory volumetric efficiency when operated with a slight back pressure. At row ends when the applicator frame is raised to permit the turn around, spring loaded check valves prevent the dripping of fumigants, the odor of which is often objectionable to operating personnel. Further, the lines remain full of fumigant at the turn around, and when the applicators are lowered into the soil and the machine starts forward, the fumigation starts immediately. This greatly reduces the unfumigated row ends which are characteristic of the gravity systems of fumigation.

The heart of the fumigation system is the pump and it is also the source of the most trouble. Our fumigant pump is a reciprocating piston pump with the volumetric displacement set to inject a specified amount of fumigant with each stroke. The pump is driven from a land wheel to provide injections on about 12-in centers, with the total number of injections per acre adding up to the desired weight of fumigant. Our standards are such that our pumps must be accurate to within plus or minus 5 lb per acre, or about 3 per cent. This pump would cost about \$500 if it were custom made outside. Each pump will fumigate 300 acres per season. The accuracy of the pump

Paper presented before the Honolulu Agricultural Engineers' Club, Honolulu, Hawaii, January 28, 1948.

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Two views of fumigant application equipment mounted on mulch paper laying machines of the California Packing Corp. in Hawaii

is such that very little fumigant is wasted and a saving of 10 lb of fumigant per acre at 15c per lb is an annual saving of \$450, which more than pays for the pump. A small grower applying fumigant to 20 acres per year would on this same basis save only \$30. Keep this comparison in mind when we go into equipment for a small grower. If we can use equipment costing less than \$100 and get application within 10 per cent of the desired amount, we have saved \$400 in initial outlay with an accuracy loss of perhaps \$30 per year.

The usual application rates are from 10 to 50 gal of fumigant per acre. This varies with the types of fumigants and other factors. This variation in amounts of application requires a flexible system and presents no small problem of pump design. With our reciprocating piston pumps we inject fumigant on 12-in centers at about 3-mph ground speed, which is 264 injections per minute. In bench tests on this equipment we tried increasing the pump speed to obtain a higher application rate, the equivalent of spacing injections closer, and found that our volumetric efficiency decreased. At a certain critical point, further increase in speed of the pump gave us a lower application rate than a lower speed under the critical point. This characteristic was not objectionable in the range of normal tractor speeds when we retained the 12-in spacing.

To obtain variation in rates of application we therefore made our pumps so that the length of stroke could be adjusted and thereby obtained more or less fumigant, but retaining our 12-in spacing of injections. This particular type of pump has gone through two seasons very satisfactorily and we now have all of our machines equipped with it. We have applied for a patent on the unique features of the pump.

As mentioned before, we apply our fumigants with the mulch paper machines and the paper is laid over the fumigated rows, thereby reducing evaporation losses to practically nothing. Other pineapple companies plow in their fumigant by what is known as the broadcast system, which means that they apply it at the time of the final plowing or after this plowing by means of subsoilers. Judging by the strong smell of fumigant in these areas, the evaporation losses must be considerable. The amount of fumigant applied broadcast is greater than when applied under the paper and therefore the per acre cost of fumigation is greater. Whether the results obtained justify the extra cost is not properly a matter for discussion at this time. In some mainland areas where fumigant is applied broadcast and overhead sprinklers are available, the evaporation loss is reduced by wetting the surface immediately after fumigation.

#### FUMIGANT LOSS REDUCED BY SOIL PREPARATION

Application of fumigants with the aid of mulch paper or water sprinklers is not practical for vegetable farming. The broadcast method is necessary and under these circumstances the use of chloropicrin is not advisable. The evaporation into the air of this toxic gas would make the area hazardous for operating crews.

The most practical method of reducing fumigant loss is good soil preparation. The plowing and harrowing should be adequate to produce a fine-textured seedbed. Not only does this serve to reduce evaporation losses, but also is generally most satisfactory for most truck crops.

A major interest is in low-cost equipment for a small grower. A brief study of the subject will show that a satisfactory piece of equipment could be made with a rotary gear pump and accessory equipment. The discussion must be based on the assumption that the small grower uses a small wheel tractor.

Most of the soil fumigation will be done at 3 to 4 mph. Fumigating a strip 6 ft wide at 3 mph, at a rate of 30 gal per acre requires a pump delivery of about 1 gpm. An all-bronze, gear-type pump carried by a local supplier will deliver 1 gpm at 20-lb pressure at 300 rpm. Using a land driver wheel about 24 in in diameter to drive the pump at a 7:1 ratio by means of chain and sprocket or V belt will give the delivery desired. This pump sells in the neighborhood of \$10. The drive from a ground wheel is recommended so that variation in ground speed will give a commensurate varia-

tion in pump output. Driving from the power take-off of the tractor would not when different gear ranges are used. Volume to be applied per acre could be changed by changing the drive ratio and thereby increasing or decreasing the speed of the pump. The accuracy of this system should be within 10 per cent, and the pump should give satisfactory service for at least 6 months to a year. The price of about \$10 permits pump replacement many times before arriving at a cost of \$500 for the more accurate unit mentioned before.

Features which have been successful on the plantation, such as foot valves and a pressure injection system, gravity flow from tank to pump, sludge-collecting sumps, measuring tanks, and a visible means of assuring that all tips are applying fumigant, should all be included in the system.

The application equipment may be in the form of the chisel-type vegetable cultivator teeth with the nozzle near the tip and the piping leading to the nozzle mounted on the rear of the chisel. These should be 12 to 15 in apart and cover a width of 6 to 7 ft and inject fumigant at a depth of 6 to 8 in. A sled or roller should be pulled behind the chisels to smooth the surface and reduce the losses of fumigant by evaporation.

To connect the various pieces of apparatus together, hose and tubing must be selected. Where pipe can be used, galvanized pipe is satisfactory. Where tubing is to be used, copper tubing is satisfactory, but it often fails due to vibration breakage. "Pigtails" help to reduce this breakage, but in general where vibration is a factor, flexible hose is more satisfactory. Synthetic and neoprene rubber-lined hose swells very rapidly when in contact with DD and what was a 1-in id hose at the time of installation is apt to be a 1/4-in hose a few hours later. Some types of plastic tubing are very successful for resisting chemical action, but after a short period of use we have found that vibration causes the tubing to collapse and that the breakage rate is high. Also, in the process of making repairs, the breakage rate of plastic fittings is rather high. Our most successful flexible hose has been of the type which has a conventional outside layer of synthetic rubber, inner plies of fabric, and an inside wall of plastic. Since galvanized pipe is reasonably resistant to corrosion, we slip the end of this hose over the end of a piece of pipe which is threaded into a coupling, union, or tank fitting and make the connection tight by banding the hose to the pipe with a banding tool.

#### OTHER FUMIGATING PUMP POSSIBILITIES

Before going into the maintenance of fumigating systems we should mention other pump possibilities. Diaphragm-type pumps made for handling chemicals may be successful, but beware of lucite materials. One lucite pump which was tried with DD dissolved in 20 minutes. Another pump which has some promise is one manufactured to meter lubricants to a number of fittings. It works to an accuracy of 5 per cent. If made from bronze or other corrosion-resistant materials, it might prove to be satisfactory.

The key to maintenance of fumigating machinery is to keep the water out. The chlorinated hydrocarbons in these fumigants form HCl when mixed with water. Even moisture from the air which condenses inside a partially filled container can soon cause considerable damage. One of the easiest control measures is to fill the supply tanks in the evening and close all vents, thereby preventing condensation of moist air during cool nights. Partially filled drums should not be allowed to sit for long periods and the contents later used (if drum is still intact and the contents haven't leaked out).

When machines are to be idle for longer than one week, the fumigant should be drained, the system flushed with diesel oil, and then filled with diesel oil. When this oil is drained to permit reuse of the machine, it may be saved and reused later. If the fumigating system is dismantled, it should be cleaned and stored immersed in diesel oil. The metal seems to absorb the fumigant, and even after cleaning a part, if it is exposed to the air for a few days, it will corrode badly.

There appears to be an opening here for a contract operator such as have been in operation in farming on the mainland. An accurate machine can save enough of a farmer's fumigant to pay the cost of an outside contractor. Anything which can be done to increase the production and reduce the cost of truck crops here in Hawaii would be welcomed by all.

# Essential Characteristics of Durable Concrete Drain Tile for Acid Soils

By Dalton G. Miller and Philip W. Manson

FELLOW A.S.A.E.

MEMBER A.S.A.E.

**T**HIS paper is based on examinations and tests of some 1100 commercial and experimental drain tile and ten thousand 2x4-in experimental cylinders. Installations of experimental specimens were made in three peats in Minnesota, three peats in Wisconsin, and an acid mineral soil in North Carolina. For comparison purposes, specimens were installed in one mineral soil in Minnesota and one in Wisconsin. Laboratory and field studies were active for the 24-year period from 1923 to 1947. Results of the work are reported upon at length in Technical Bulletin 180 of the Minnesota Agricultural Experiment Station, and it is the purpose here to present to members of the American Society of Agricultural Engineers the essential conclusions as devoid as possible of details.

## SUMMARY

1 The degree of action on the commercial concrete tile taken from 12 Wisconsin drainage systems, installed in peat 20 to 26 years, greatly varied between systems ranging all the way from negligible etching to complete disintegration of the tile. It was not clear from the data just what influence either tile quality or soil acidity had on durability, but in the two systems where complete disintegration had occurred the tile were very low in quality, as determined by strength and absorption test, while the soil acidities, as measured by pH values of 5.9 and 6.4, were highest and second highest of the 12 locations.

2 Behavior of the experimental tile was essentially the same as that of the commercial tile in that the strength trends were downward for the tile installed in peat with pH values of 5.9 and 8.0. For the commercial tile from 7 systems in peats with pH values from 5.9 to 7.5, the loss in breaking strengths average 260 lb during the 17 years between tests,

This paper was presented at the annual meeting of the American Society of Agricultural Engineers at Portland, Ore., June, 1948, as a contribution of the Soil and Water Division. A report of work conducted under a cooperative agreement between the Public Roads Administration of the Federal Works Agency, the Division of Agricultural Engineering of the University of Minnesota, the Division of Water Resources of the Minnesota Department of Conservation, and, informally, with the Department of Agricultural Engineering of the University of Wisconsin. (In 1946, the graduate school of the University of Minnesota allocated a limited sum of money to aid in the preparation of reports.) In the files of the University of Minnesota this is Paper No. 2413, Scientific Journal Series.

DALTON G. MILLER is materials engineer, Public Roads Administration, Federal Works Agency, and PHILIP W. MANSON is professor, division of agricultural engineering, University of Minnesota.

while for the 8 lots of experimental tile in the two peats with pH values of 5.9 and 8.0, the average loss was 550 lb in 14 years. Considered together the loss in supporting strengths of all these tile, after an average period of 15½ years in peat, was slightly more than 400 lb per lineal foot.

3 The strength trends of the experimental cylinders of plain concrete and mortars were strikingly similar to those of the drain tile, with the result that for the 14 years between exposures for 5 and 19 years, the concrete cylinders with 28-day compressive strengths around 5000 psi lost an average of about 1170 psi in the peats with pH values of 4.1, 5.1, and 5.4. Tests of the low strength mortar cylinders of 1,000 psi exposed in peats with pH values of 4.1 and 5.1 showed a loss of 750 psi following exposures for the 12 years between 5 and 17 years, with the data indicating a loss of 860 psi had the exposures continued another 2 years. Expressed as percentages, the strength loss of the concrete cylinders was 18 per cent of the strength at 5 years, whereas the mortar cylinders lost 45 per cent of the strength at 5 years.

4 Peat acidity as measured by pH determinations is a fair indicator of the degree of corrosive action to be expected on concrete.

5 Acidities of the three mineral soils as measured by pH determinations did not furnish as reliable an index of corrosive action on concrete, as for the peats. No exact explanation is offered for this apparent discrepancy between pH values of peats and mineral soils.

6 Based on other phases of the investigations not reported upon in this paper it has been found that:

(a) None of six admixtures of different types increased resistance of the cylinders in which used.

(b) Variations in the chemistry of twenty different cements had little effect on resistance to the soil acids with the exception of the high alumina cements which were somewhat more resistant than were any of the portlands.

(c) Specimens cured in steam at temperatures of 155, 212, or 285 F did not resist peat action appreciably better than did water-cured ones, but those cured at 345 F held up in strength throughout the 17 years they were under observation.

(d) The only surface treatments used were linseed oil and a cutback bituminous product. Both these somewhat increased the resistance of the concrete cylinders to which applied.

## CONCLUSION

It would be unfair to prospective users of drain tile of the smaller diameters to conclude this report without a direct

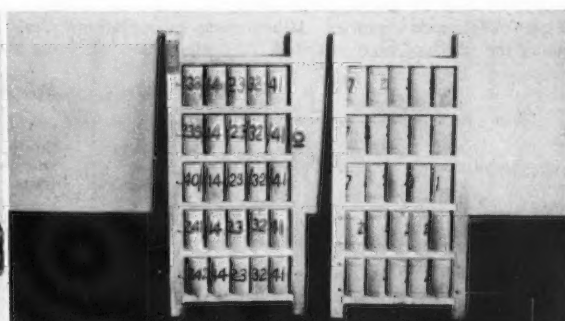
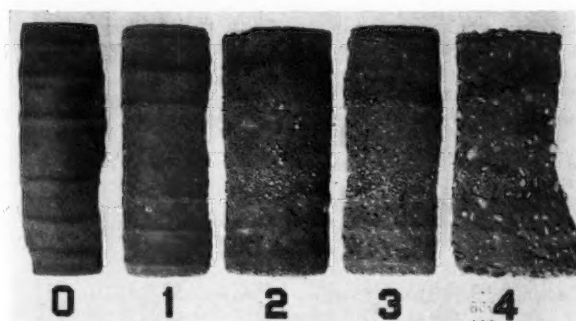


Plate 1 (Left) Sections of commercial drain tile after long-time service in tile lines installed in peats. The degree of etching was influenced by soil acidity and tile quality when installed • Plate 2 (Right) Four hundred crates of experimental cylinders were installed at 8 locations

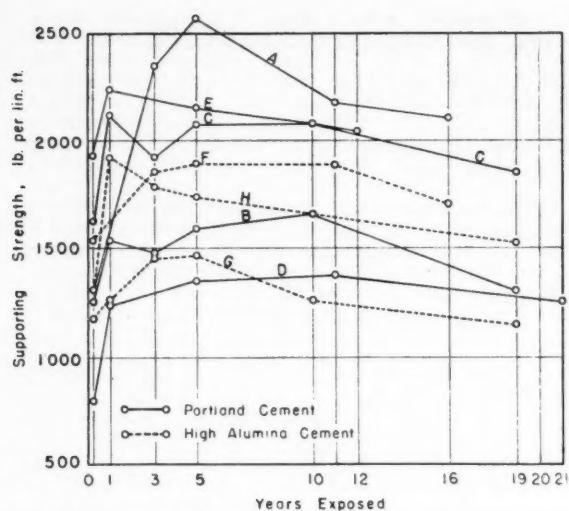
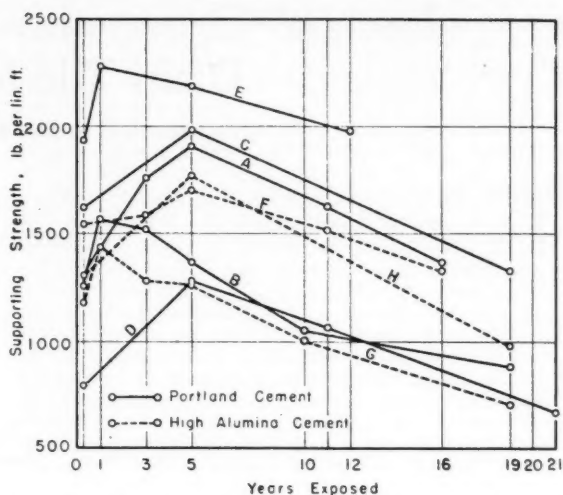


Fig. 1 (Left) Supporting strengths of 5 and 6-in experimental concrete drain tile installed in one or the other of two mineral soils with pH values of 5.4 and 8.2. Each point is the average of 4 to 10 tile. These are check tests for tile from peat of Fig. 2. (The letters on the graph refer to manufacturing and test data.) • Fig. 2 (Right) Supporting strengths of 5 and 6-in experimental concrete drain tile installed in one or the other of two peats with pH values of 5.9 and 8.0. Each point is the average of 4 to 13 tile. (The letters on the graph refer to the manufacturing and test data)



statement to the effect that practically all concrete and mortar specimens so far examined have shown some evidence of corrosive action where the exposure periods in peat have been around 20 years. In general, the degree of corrosion has varied with the acidity of the peat and the unit strength of the test piece, whether drain tile or cylinders. It is therefore not the best practice to lay concrete drain tile of the smaller sizes, as ordinarily made, in the more acid peats. On the other hand, well-made concrete drain tile should give reasonably satisfactory service for many years when laid in the low acid grass and sedge peats that favorably respond to cultivation without much liming. The degree of acidity of such peats, when expressed by the hydrogen ion scale, will have pH values of 6.0 or more.

High-quality drain tile are made with concrete in the finished pipe having 28-day strengths not less than 3,500 psi. For drain tile of the smaller diameters this means breaking strengths around 1600 lb per ft of length and average absorptions below 8.0 per cent, after boiling for 5 hr following oven drying. Under proper plant controls, drain tile of this quality can be made on packer-head-type machines now in common use as this is being done at a few plants. The final conclusion is to the effect that low-quality concrete drain tile are not suitable for drainage of any peats.

#### DETAILS OF PROCEDURE

**Field Examinations in Wisconsin.** Examinations were made in 1923-25 of 12 concrete tile systems located in 5 south-eastern Wisconsin counties. When these examinations were made, the tile had been installed for periods ranging from 3

to 9 years, averaging between 5 and 6 years. Re-examinations were made of a number of the same tile systems during the fall of 1940 when the tile had then been in service for periods that averaged between 22 and 23 years.

The general plan followed in these field examinations was to locate tile lines which had one or more sections in peat and one or more sections in mineral soil, preferably clay. Tile were then taken from the two types of soil and tested for bearing strength and absorption. This did not always work out too well because some of the installations were in relatively small islands of mineral soil surrounded by peat, were overlaid by peat, or drained peat areas further up the tile line. Any one of these conditions introduced the possibility that soil water from the peat finally made contact with the tile even though laid in mineral soil. This could account for the fact that the surfaces of tile from some of the installations in low-acid mineral soil were definitely etched and the tile had lost strength during the 17 years between tests. In all cases the tile were tested without any culling, except to reject cracked specimens.

**Experimental Drain Tile.** During the field examinations it became evident that the data were incomplete in regard to the known properties of the tile previous to installation. Therefore, between the fall of 1923 and the spring of 1932 there were made several hundred 5 and 6-in drain tile at one Wisconsin and two Minnesota plants and installed in peats and mineral soils in Wisconsin and Minnesota. All tile were of 1-3 mixes by volume, except only those of high alumina cement which were 1-4 mixes. The portland cement tile were of 5 and 6-in diameters while all the high alumina cement

TABLE 1. ANALYSES OF SOIL SAMPLES

(NOTE: Each result is the average of several samples taken in different years. All values are in per cent on oven-dry basis)

Installation	pH values	Moisture as received	Moisture, air-dried 105-110 C	Acidity, Truog method	Total calcium oxide (CaO)	Total sulphur	Total organic matter	Total soluble salts
D Grand Rapids, Minn.	4.1	85.16	12.95	0.027	0.83	0.47	93.34	0.07
DD Marshfield, Wis.	4.3	75.13	14.18	0.096	0.92	0.69	63.34	0.06
DD <sub>2</sub> Wilson, N. C.	4.9	6.24	0.25	0.013	0.40	0.035	Trace	0.02
CC Coddington, Wis.	5.1	79.75	11.90	0.010	1.95	2.01	53.85	0.51
DD <sub>3</sub> Phillips, Wis.	5.4	70.28	16.90	0.015	3.16	1.22	62.93	0.14
A Univ. Farm, Minn.	5.4	24.19	4.87	0.008	1.50	0.13	5.93	0.04
BB Beebe Estate, Wis.	5.9	81.01	16.92	0.013	5.26	3.61	73.59	0.99
B Coon Creek, Minn.	8.0	81.19	5.45	0.010	6.94	1.25	59.40	0.46
C Karlstad, Minn.	8.2	58.29	10.70	0.003	8.28	0.72	27.27	0.16
AA Univ. Marsh, Wis.	8.2	26.67	2.38	0.003	3.48	0.07	Trace	0.04

TABLE 2. ANALYSES OF THE SOLUBLE SALTS SHOWN IN THE LAST COLUMN OF TABLE 1

(NOTE: All values are in per cent on oven-dry basis)

Installation	Total salts	Ca as CaO	Mg as MgO	SO <sub>3</sub> as SO <sub>4</sub>	Na as Na <sub>2</sub> O	K as K <sub>2</sub> O
D Grand Rapids, Minn.	0.07	0.043	0.014	0.023	0.013	0.013
DD Marshfield, Wis.	0.06	0.021	0.010	0.029	0.017	0.003
DD <sub>1</sub> Wilson, N. C.	0.02					
CC Coddington, Wis.	0.51	0.125	0.047	0.309	0.022	0.004
DD <sub>2</sub> Phillips, Wis.	0.14	0.046	0.047	0.038	0.017	0.002
A Univ. Farm, Minn.	0.04					
BB Beebe Estate, Wis.	0.99	0.224	0.086	0.658	0.020	0.005
B Coon Creek, Minn.	0.46	0.161	0.019	0.260	0.015	0.005
C Karlstad, Minn.	0.16	0.071	0.0435	0.078	0.013	0.009
AA Univ. Marsh, Wis.	0.04					

tile were of 6-in diameters. Except that all materials used in the manufacture of the experimental tile were weighed, there was no intentional departure from the routine ordinarily followed at any plant. Strength trends of all the eight lots of tile are shown in Figs. 1 and 2, respectively.

**Analyses of Soils From the Experimental Sites.** Determinations of pH values of the subsoils from the various experimental sites were made by the Division of Soils of the University of Minnesota. In the early phases of the work in Wisconsin, the department of soils of the University of Wisconsin closely cooperated and it was largely due to suggestions by that department that the determination other than pH values were made. However, credit for actually making all the determinations reported in both Table 1 and Table 2, excepting the pH values of Table 1, is entirely due the Bureau of Soils, now a part of the Bureau of Plant Industry, Soils, and Agricultural Engineering of the U. S. Department of Agriculture.

**Experimental Concrete Cylinders.** Installations of experimental concrete cylinders were made in three peats and one mineral soil in Wisconsin, three peats and one mineral soil in Minnesota, and one acid mineral soil near Wilson, North Carolina. A total of 10,000 2x4-in concrete and mortar cylinders were installed at the nine locations and include 50 variables. The cylinders were installed in copper-nailed wooden crates that were marked with copper tags and by burned-in numbers (Plate 2). Twenty-five identical cylinders were installed in each crate. All cylinders were made of mixes which

could be approximated in the commercial manufacture of farm drain tile.

The laboratory cylinders used in the tests were made of aggregates that met standard physical test requirements. The aggregates were separated into screen sizes and recombined as shown in Table 3 to produce a fineness modulus of 4.67. The cylinders were mostly made in batches of 9, requiring 3531 g of aggregate for the 1-3 mixes. For other mixes the quantity was varied to produce batches of about equal volumes.

TABLE 3. SIEVE ANALYSES OF AGGREGATE USED IN 2 x 4-IN LABORATORY CYLINDERS

Sieve	Per cent coarser than
3/4	.0
4	43.7
8	63.7
16	75.6
30	87.5
50	96.9
100	100.0
Residue	Trace
Fineness modulus = 4.67	

For the purposes of this paper, it is believed that the essentials of the cylinder tests are fairly illustrated by the graphs of Figs. 3, 4, and 5. Study of Fig. 3 reveals that the average strength of the high-strength concrete cylinders increased continuously with exposure in the mineral soils. In the peats

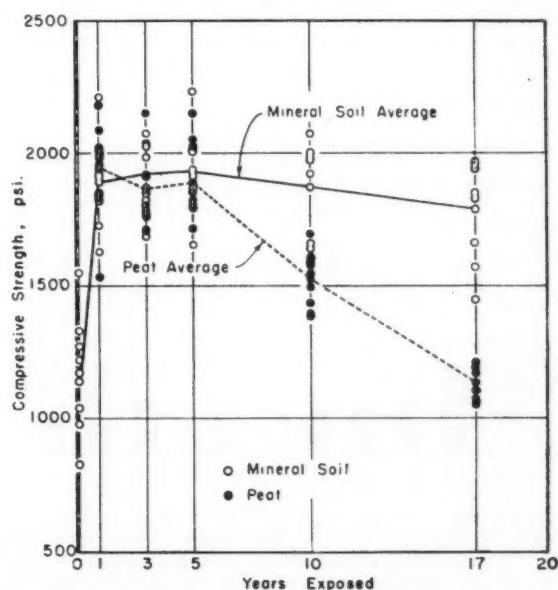
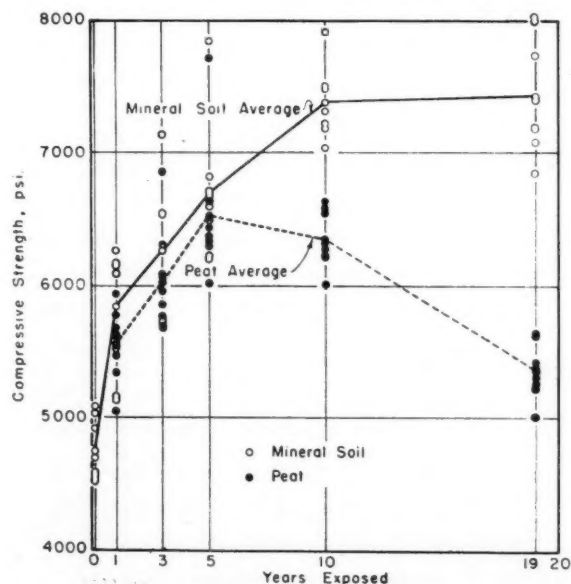


Fig. 3 (Left) Average strengths of concrete cylinders after installation in three peats with pH values of 4.1, 5.1, and 5.4, compared with average strengths of check cylinders installed in two mineral soils with pH values of 5.4 and 8.2. A different cement was used in each of the eight series of cylinders. The mix was 1-3 by volume. Fig. 4 (Right) Average strengths of 1-5 Ottawa standard sand cylinders after installation in two peats with pH values of 4.1 and 5.1 compared with average strengths of check cylinders installed in two mineral soils with pH values of 5.4 and 8.2. A different cement was used in each of the nine series of cylinders and the mix was 1-5. The cements were not the same brands as those used in the concrete cylinder of Fig. 3

a decrease started at 5 years and by 19 years, the strengths had fallen below those at 1 year. Study of Fig. 4 shows that the low-strength mortar cylinders lost slightly in strengths in the mineral soils and markedly in the peats after 5 years. It will be noted that while there was considerable spread in strengths of the cylinders tested at the different ages, the general picture was a weakening of both concrete and mortar cylinders in the peats with a narrowing of the strength spreads for both types of cylinders longest in peat. It is evident from the 17 and 19-year tests that none of the 17 portland cements used in the cylinders upon which Figs. 3 and 4 are based displayed unusual acid resisting properties.

Reference to Fig. 5 shows that strength changes of the cylinders were fairly well correlated with the pH values of the six peats but were not correlated with the pH values of the three mineral soils. The authors offer no explanation for this.

#### RECOMMENDATIONS

There are four basic requirements to be met in the manufacture of concrete drain tile of the smaller diameters, made on the "packer-head" machines in common use, if the output is to be high in quality as indicated by tests for supporting strength. These are: (1) Well-graded, sound aggregates, (2) rich mixes, (3) adequate compaction of the materials in the tile machine, and (4) adequate curing.

1 *Well-Graded, Sound Aggregates.* The essentials of good grading for the dry mixes used in the manufacture of drain tile of the smaller diameters on the packer-head machines may be expressed briefly as not less than 40 per cent on the No. 8 sieve with preferably somewhat more than half of this on the No. 4 sieve. As an illustration, Table 4 shows strength and absorption tests of some 4-in commercial drain tile and the sieve analyses of the aggregates used. This probably is about as coarse a grading as it is feasible to use in tile as small in diameter as 4 in.

2 *Rich Mixes.* It is doubted that drain tile of the smaller diameters, with nominal wall thicknesses can be made on standard packer-head machines which will have 28-day supporting strengths that are consistently as high as the foregoing unless the ratio of cement used approaches 1-2½ by volume of the aggregates.

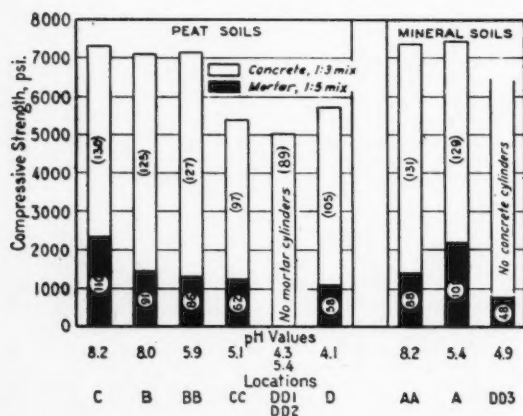
3 *Adequate Compaction of the Materials at the Machine.* This is brought about by using as wet a consistency as can be handled without undue slumping when the jackets are removed and by keeping the packer shoes in first-class condition. This necessitates frequent replacement with new, or rebuilt, shoes to compensate for the wear. The tremendous importance of proper compaction is brought out by Fig. 6 based

on tests of 2 x 4-in cylinders made of aggregates combined as they are for commercial tile at one plant. These cylinders were identical in all respects, except for the degree of compaction that resulted from variations of tamping the material into the molds. Study of this figure shows that the compressive strengths ranged from a low of 1200 psi to an extreme high of 7200 psi, while the absorptions ranged from a high of 15 per cent to a low of 3.5 per cent. In the walls of drain tile of the smaller diameters, this would have resulted in tile with supporting strengths ranging from 480—600 lb per linear foot to highs of 2,880—3,600 lb per linear foot, in accordance with the relationships discussed below.

TABLE 4. PHYSICAL TESTS OF HIGH-QUALITY, 4-IN COMMERCIAL DRAINTILE AND SIEVE ANALYSES OF AGGREGATES USED

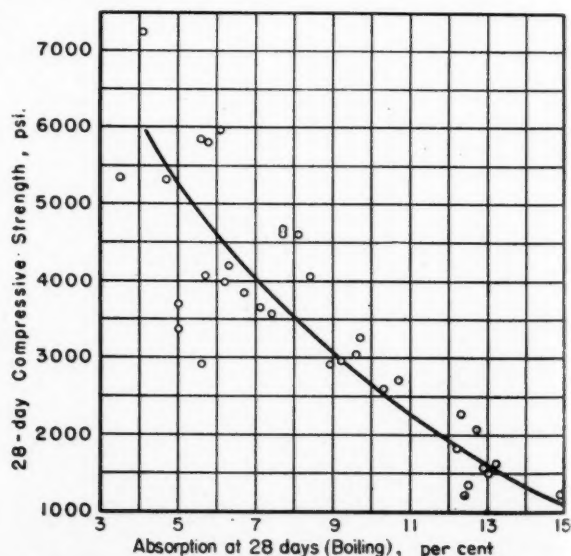
Tile tests		Sieve analyses of aggregates	
Supporting strength, lb per lin ft	Absorption, oven-dried, boiled 5 hr, per cent	Sieve number	Per cent coarser than
1570	6.0	¾	0.0
1550	5.9	¾	0.2
1620	6.9	4	26.0
1880	5.7	8	40.7
2210	6.3	16	50.6
1890	6.1	30	62.4
1450	5.8	50	86.0
2220	5.9	100	97.1
1740	6.2	Residue	2.9
1650	5.8		Fineness modulus=3.63
Ave. 1780	6.1		

4 *Adequate Curing.* It is always advisable to cure drain tile in accordance with well-established good practices in order to insure adequate strengths for the load requirements. It is of particular importance that concrete drain tile be well cured before they are installed in acid soils as resistance to any corrosive action is of a much lower order for poorly cured concrete than it is for concrete which has had ample moist curing followed by hardening in air for as long as practicable. It is not good practice to install concrete tile at an age much under 30 days.



Note: Figures in parentheses and circles are strength ratios at 17-20 years based on 1-year strengths.

Fig. 5 (Left) Strengths of concrete cylinders after installation for 19 to 20 years and mortar cylinders after installation for 17 years in peat and mineral soils with pH values as indicated. Each value for the concrete cylinders is the average for 40 cylinders, 5 each of 8 cements, while each value for the mortar cylinders is the average for 45 cylinders, 5 each of 9 cements. The cements used in the concrete cylinders were brands other than those used in the mortar cylinders • Fig. 6 (Right) Correlation between strength and absorption of 2 x 4-in cylinders tamped to produce different degrees of compaction. The mix was 1:3 and the aggregate combination was identical with that used at the commercial tile plant which furnished the aggregate



**High-Quality Drintile for Peats.** All the tests of drintile and cylinders upon which this paper is based show that the concrete specimens of high-unit strengths best resisted the action of the peats. So many of the conclusions are based on tests of both drintile and cylinders that it became necessary to convert as well as could be done the supporting strengths of the drintile, expressed in pounds per linear foot, into compressive strengths of the cylinders, expressed in pounds per square inch. It is not feasible in this short paper to do more than report this relationship. The reader is referred to the Minnesota Agricultural Experiment Station Technical Bulletin 180 for the details involved in the determinations. The following table shows the general relationships that are believed to exist; note that the values in Column B, showing the 28-day compressive strength of the concrete in the tile walls in pounds per square inch are mostly 2 to 2½ times the supporting strength of the drintile in pounds per linear foot shown in Column A:

A—Supporting strength of drintile at 28 days, lb per lin ft	B—Approximate 28-day compressive strength of the concrete in the tile walls, psi
800	1500—2000
1000	2000—2500
1200	2500—3000
1400	3000—3500
1600	3500—4000
1800	4000—4500
2000	4500—5000

Admittedly these relationships can vary considerably, but they are thought to be fairly dependable averages for drintile of diameters from 4 to 15 in with wall thicknesses, as ordinarily manufactured on packer-head machines in common use, about as follows:

Diameter of tile, in	Wall thickness of tile, in
4	9/16
5	5/8
6	5/8
8	3/4
10	15/16
12	1 - 1/8
15	1 - 1/4

The compressive strengths of the concrete cylinders upon which much of the work of this paper was based were mostly between 4500 and 5000 psi, and, as has been shown, it was not until these strengths were reached was resistance to the soil acids of a really high order. It appears, therefore, that drintile of the smaller diameter, to be equally resistant, will have supporting strengths around 2000 lb per linear foot. This is 25 per cent higher than the 1600 lb now required for "Extra Quality Drintile" of the Standard Specifications for Drain Tile, ASTM Designation C4-24.

## Further Data from Siphon Tests

By C. N. Johnston

MEMBER A.S.A.E.

IN AN earlier paper,<sup>1</sup> the behavior of 2-in metallic siphons under various heads was given. Since then a rubber siphon of approximately 1½-in inside diameter became available and in addition an 8-in and a 5½-in metallic siphon was provided for test. The rubber hose siphon has about a ¼-in wall, within which has been molded a spiral of iron wire for stiffening. The need for stiffening would appear to be in the probable collapse of the tube under the siphoning partial vacuum. The over-all length of the rubber siphon was 45 in, a little shorter than the 60-in long, 2-in metallic models. The two larger siphons are, in order of size, respectively, aluminum and galvanized iron. These large units are too heavy to handle by hand easily and are equipped with a canvas sleeve at one end for use in priming. After the siphon is filled by submersion in the source, the canvas sleeve is rolled up to form a seal and that end of the siphon is lifted over the ditch bank, possibly by hand, but often using a truck or car to drag it into place. A short length of chain fastened to the sleeve end of the siphon facilitates this manipulation. The intake ends of the large siphons have a strap or foot across the end about 2 or 3 in from the actual inlet face. This permits the siphon to rest on the foot so the intake is held above the bottom of the supply when the water is shallow. Otherwise the inlet might be plugged if it rested directly on the muddy bottom. The over-all lengths are 10.5 ft for the aluminum 5½-in ID siphon, and 11.5 ft for the 8-in ID galvanized siphon. The metallic siphons had outside welded angle joints similar to the brazed joint 2-in siphons described earlier.

Because the rubber siphon was flexible, it was thought its *b-Q* characteristics might change if it were deformed to fit a wider or narrower ditch levee or similar objects. Tests were made on it in several positions, but no change in capacity was noted. The over-all efficiency varies from 71 per cent at 0.1-ft head to 64 per cent when *b* = 0.5 ft.

The tests on the two large diameter siphons included a

check run of each as it came from the factory and with the strap, or foot, some distance from the bottom of the supply tank; then with a steel plate under the foot to simulate contact of foot and bottom; with the priming sleeve removed; and with the strap on the intake extended to provide greater port clearance. One factor regarding these tests should be noted. It was found that if they were run from low heads progressively up to higher, the resultant *b-Q* curve fell to the left of data plotted when the high head was used first with the head progressively decreasing during the test. Trapped air in the low to high head run would seem to be the explanation for the difference in results between the two tests. To eliminate any question, these tests were run with an aspirator operating at the top of the siphon throughout the run. The straps, almost 2 in wide, were within 3 in of the face of the inlet as they came from the factory. Both the canvas priming sleeve and the use of the artificial bottom below the foot tended to decrease flow materially, while the change in strap or foot lengths had little effect.

EDITOR'S NOTE: More detailed data on test results are available from the author to engineers particularly interested.

## Values of Technical Meetings

THE lifeblood of technical groups is the technical meeting, and the number and quality of the technical meetings depend upon the availability and quality of the technical papers. The preparation of technical papers for publication or for presentation at meetings and conventions is a particularly potent form of engineering development, from the standpoint both of the engineer and of the profession. . . . It requires a thorough study of the material previously published on the same and allied subjects, a recognition of the limitations of that knowledge, and a logical organization of the material in the engineer's mind for most effective presentation. The unique and intensive mental activity engaged in by the engineer during the process of preparation of a technical paper is development along engineering lines in its most effective form. For this reason, it should play a major role in the company's plan of engineering development at the advanced level.—From "Industry Develops Engineers," by Theo. B. Jochem, in "Mechanical Engineering" for September, 1948.

This paper was prepared expressly for AGRICULTURAL ENGINEERING.

C. N. JOHNSTON is associate professor of irrigation and associate irrigation engineer in the experiment station, University of California (Davis).

<sup>1</sup> Johnston, C. N. Comparison Performances of Metallic and Plastic Siphons for Irrigation. AGRICULTURAL ENGINEERING, 27 (10): 469-470, October, 1946.

# The ASAE "Best Bulletin" Display

By Milton R. Dunk

ASSOCIATE A.S.A.E.

**D**O FARMERS read the educational agricultural engineering information released by public agencies and private industry? If they do, the information should be presented in an attractive and readable form.

One of the objectives of the ASAE Committee on Extension has been to stimulate interest in better bulletins. All ASAE members had the privilege of submitting a booklet or bulletin produced by their agricultural college, company, or trade association in the "Best Bulletin" exhibit, held during the 1948 ASAE annual meeting at Portland, Ore., June 20 to 23.

Some 200 pieces of literature were sent in to be exhibited. While not all the material qualified, it does show the interest of members in better publications. The bulletins and booklets were attractively displayed on two large boards. One board was used for industry bulletins and the other for state college and USDA bulletins.

Members were continuously viewing the booklets during the meeting. Many copied down the names of booklets and their sources because they wanted to order them for their files when they returned home. C. L. Hamilton of the National Safety Council stated, "It took me the best part of an hour to copy down the names of bulletins in which I was interested." Some of the award winner bulletins were removed from the display at the close of the meeting. Evidently the material was of such interest that they took the bulletins and left the blue ribbons. Of the 107 officially recorded entries in the extension bulletin display, 23 merited the blue ribbon award. Companies, agricultural colleges, and trade associations receiving the coveted distinction, with the title of the publication submitted, are as follows:

- Barn Equipment Ass'n., Chicago, Ill.—"Rejected"
- J. I. Case Co., Racine, Wis.—"Handling Manure for Extra Profits"
- Colorado A. & M. College, Fort Collins—"Design for Outdoor Living"
- Department of Agriculture, Swift Current, Sask.—"A Guide to Farm Home Planning and Modernization"
- International Harvester Co. of Australia—"Let's Improve Our Pastures"
- Michigan State College, East Lansing—"Homes for Seasonal Farm Help"
- Missouri Limestone Producers' Assn., Jefferson City—"Milk Production and Utilization in Missouri"
- National Education Assn., Washington—"Safety in Farm Mechanics"
- Oklahoma A. & M. College, Stillwater—"Water Systems for the Farm Home"
- Pennsylvania State College, State College—"Manual of Demonstrations and Lessons in Teaching Farm Wiring"
- Portland Cement Assn., Chicago—"Concrete Structures for Farm Water Supply and Sewage Disposal"
- Puget Sound Power & Light Co., Seattle—"Electric Gardening"
- Standard Oil Co. (Ind.), Chicago—"Farm Tractors"
- State College of Washington, Pullman—"Planning Your House"
- University of British Columbia, Vancouver—"Repairs to the Farm Home"
- University of California, Berkeley—"Portable Cleaners for Seed Grain"
- University of Maine, Orono—"Building and Remodeling Dairy Barns"

MILTON R. DUNK is editor, *Better Farming Methods*, and member, ASAE Committee on Extension.

- University of Nebraska, Lincoln—"Farm Sewage Disposal"
- University of Wisconsin, Madison—"Remodel Farm Home"
- U. S. Department of Agriculture, Washington—"How to Plan Remodeling"

West Penn Power Co., Pittsburgh—"Planned Electric Water Heating"

Westinghouse Electric Corp., Pittsburgh—"Facts"

Weyerhaeuser Sales Co., St. Paul—"The High Cost of Cheap Construction"

It should be pointed out that it was the decision of the judges that only one bulletin from an institution, company, or association could be given a blue ribbon award.

This is in harmony with the objective of the Committee on Extension set up at the start of the planning, in connection with the judging. For this reason, not all of the top-scoring publications were awarded a blue ribbon.

The following score card was used in rating the blue ribbon winners:

1	First Impression .....	20	Points
2	Organization of Material .....	30	"
3	Readability .....	30	"
4	Action Inspiration .....	10	"
5	Low Cost .....	10	"

Item 5 on the score card caused the most controversy among the capable staff of judges, which included: Mrs. T. Karl Dimmitt, Seattle; Mr. and Mrs. T. L. Coulthard, University of British Columbia; Mr. and Mrs. Henry Giese, Iowa State College; L. A. Hawkins, International Harvester Co.; J. G. Herndon, University of Georgia; Leo W. Larsen, John Deere Harvester Works, Deere & Co.; Mr. and Mrs. Chas. A. Mathews, American Zinc Institute; Geo. B. Nutt, Clemson Agricultural College; V. S. Peterson, E. I. DuPont de Nemours & Co.; R. R. Poyner, International Harvester Co., and J. H. Westman, International Harvester Co. The judging took place June 19 and 20, prior to the start of the ASAE annual meeting.

Other publications rated in the top 55 of the 109 entries were as follows:

- Alabama Power Co., Birmingham—"Wiring Guide for the Farmstead"
- American Zinc Institute, Chicago—"How to Make Galvanized Roofing and Siding Last"
- Barn Equipment Assn., Chicago—"More Profit with Labor Saving" and "Planning the Dairy Barn"
- General Electric Co., Schenectady—"Modern Farm Help"
- General Motors Corp., Detroit—"Frozen Food Inventory" and "75 Answers"
- International Harvester Co., Chicago—"Your Farm Equipment" and "Let's Practice Soil Conservation"
- Kansas State College, Manhattan—"Wiring the Farmstead", "Contour Farming", and "Terracing"
- Michigan State College, East Lansing—"Septic Tanks" and "Vertical Cup-Type Elevator"
- National Retail Farm Equipment Assn., St. Louis—"Selling Farm Equipment"
- National Safety Council, Chicago—"Make Your Farm Safe" and "Hand Tools Don't Cause Accidents"
- Oregon State College, Corvallis—"Corn Drying"
- Spreckles Sugar Co., Sacramento—"Sugar Beets"
- State College of Washington, Pullman—"Your Farm Home—Make It Work", "Hand Clearing", and "The Utility Room"
- United Light & Railway Service Co., Davenport—"A Wiring Plan"

- University of Connecticut, Storrs—"When You Buy a Freezing Cabinet"
- University of Kentucky, Lexington—"Electric Water Systems"
- University of Wisconsin, Madison—"Farm Wagon Rack"
- U. S. Department of Agriculture, Washington—"Insulation and Weatherproofing", "Planning the Bathroom", and "Cut-Outs to Help in Planning"
- Westinghouse Electric Corp., Pittsburgh—"Electric Farmers" and "Farmstead Wiring"

ASAE members were so enthusiastic about the best bulletin exhibit this year that they indicated a desire that a similar one be displayed at the Society's annual meeting at East Lansing, Michigan, June 20 to 22, 1949.

The following suggestions have been offered for improving the activities of the Committee on Extension in 1949: (1) Why not invite participants in a similar display of their best blueprint plans for buildings, their best blueprint plans for machinery, their best movie produced during the year, their best slide set, and perhaps even their best model. (2) Feature radio and press at the winter meeting. (3) Mimeograph list of bulletins exhibited. (4) Limit the bulletins or booklets exhibited to those published during the previous year. (5) Limit all entrants to only one best bulletin.

Another important feature sponsored by the Committee on Extension during the ASAE annual meeting was the evening session on June 21, which opened with a report by G. B. Gunlogson, president, Western Advertising Agency, Racine, Wis., entitled "What Farmers Think About Educational Booklets and Bulletins." Copies of this report are available to ASAE members on request.

Cecil Hagan, managing editor, Pacific Northwest Farm Trail, addressed the session on "What Makes a Publication Readable." Since quite a number of ASAE members either supervise the production of movies or select and use them, Larry Sherwood, vice-president, Calvin Co., Kansas City, Mo., discussed the "Production, Selection, and Use of Educational Movies." Sherwood's talk provoked an unusual amount of favorable comments.

W. G. Kaiser, Portland Cement Association, made this comment in regard to the program arranged by the Committee on Extension at Portland: "Even though we did not hold a formal Committee meeting in Portland, I was greatly impressed with the program that had been arranged by our committee. In fact, to me it was one of the most interesting

programs I attended during the entire ASAE meeting. I don't know who deserves the credit for planning this fine program, but I think he merits a vote of thanks. I especially like the idea of the booklet and bulletin display. I want to congratulate the Committee on the way the activity was handled. I hope this idea will be continued at future ASAE meetings, because of its educational value."

L. G. Samsel, chairman, ASAE Committee on Extension, worked hard this past year to make the extension program worth while. He deserves a big orchid from his fellow ASAE members. C. N. Hinkle, Standard Oil Co. (Ind.), another member of the Committee on Extension, deserves a lot of credit for his work on the bulletin display.

The Committee on Extension welcomes comment from ASAE members, concerning improvement of its activities in 1949.

## Industry Develops Engineers

A COLLEGE graduate is not a full-fledged engineer, and it is just as erroneous to consider him such as to consider the graduate of a medical school a full-fledged doctor before his internship. Just as a doctor spends several years as an intern, so must the engineering graduate spend some time in a more or less intensive training period designed to bring his basic knowledge into harmonious relationship with the practical applications peculiar to the particular industry in which he is employed. . . . Industry owes something to the profession.

To maintain a position in a competitive field, a company must draw heavily on the store of engineering knowledge accumulated through the activity of a countless number of technically trained minds, a store of knowledge to which the company may have contributed little. However, every right imposes a corresponding duty, and every industry has the obligation of adding to that store of knowledge from which it has drawn and from which others will draw in the future. This storehouse is the record of achievement of the members of the engineering profession, and it grows and expands through individual and unique mental activity of the engineer. Much of this mental activity is self-stimulated. However, management can play an important role in prodding the engineer's interest, in making available the means of self-improvement, and in training the engineer actively, at least along the lines of the particular field in which the company operates.—From "Industry Develops Engineers," by Theodore B. Jochem, in "Mechanical Engineering" for September, 1948.



The "Best Bulletin" display sponsored by the ASAE Committee on Extension at the Society's 1948 annual meeting, at Portland, Ore., in June. The exhibit was viewed continually during the meeting. A few ASAE members were on hand when this picture was taken and include (left to right) C. N. Hinkle, Standard Oil Co. (Ind.); M. M. Jones, University of Missouri; W. G. Kaiser, Portland Cement Assn.; R. C. Hay, University of Illinois, and E. L. Barger, Iowa State College

# The Development of Rural Electrification in the Pacific Northwest

By L. J. Smith

MEMBER A.S.A.E.

IT HAS been said that surroundings and environment have a vital influence on our lives and activities. The statement seems especially applicable to those who live in newly developing areas of great resources. When I came back to the "states" in the early twenties, from the University of Manitoba, where I had developed a department of agricultural engineering, it was with the hope that I would continue to work mainly in the farm structures field. Washington was in a great timber region and was fast developing as a state of great diversity of agriculture. But while it was possible to do some work in farm buildings and publish a number of bulletins, it soon became evident that a major effort should be made towards a new phase of agricultural engineering. Intensive work in farm buildings was to be delayed for nearly 25 years.

At that time two great divisions of agricultural engineering had not been seriously considered, and were seldom mentioned in Society's publications. I refer to rural electrification and soil conservation. Yet both were soon to become of major importance in the Pacific Northwest.

The then few agricultural engineers in this part of the United States scarcely realized the importance of the hydraulic-electric resources of the Northwest—two-fifths (17,734,000 hp) of all the water power of the whole United States, one-half of which (8,768,000 hp—90 per cent basis) was in Washington alone. (As of December, 1945, the installed generator capacity of the dams in Washington was 1,636,000 kw, with 266,000 kw for Idaho and 720,000 kw in Oregon.) Nor was it very significant that two of the mighty rivers of the world with their tributaries drained this fast-developing area. With 60,000 now homeless because of the present disastrous flood conditions due to continuous rains and early melting snow fields, we cannot escape the possibilities of both production and destruction from such resources or of the immediate need for their fullest possible development and control.

In the early twenties, farmers were asking what electricity might do for agriculture. It was being used increasingly in the city and in manufacturing, but a relatively small per cent of farmers close to the cities or on concentrated acreages, were enjoying any of its benefits.

At that time, the national Committee on the Relation of Electricity to Agriculture was formed, and Dr. E. A. White, with the blessing and cooperation of the power companies, the heads of the various land-grant institutions, and the deans

of colleges of agriculture and engineering, helped organize state rural electric committees in the three northwestern states. A committee was formed at Oregon State College in early 1925, Washington and Idaho following the movement in quick succession. Surveys were made to, first, learn to what extent and in what ways electricity was being used in the agriculture of the Pacific Northwest and, second, to determine what studies and research should be undertaken in order that electricity might be used in as many ways as possible to the economic advantage, both of the producer and the consumer.

M. R. Lewis and Hobart Berresford in Idaho; W. J. Gilmore, Geo. W. Kable, F. E. Price, and Larry Moore in Oregon, and H. L. Garver, J. C. Scott, D. B. Leonard, and myself in Washington, were active in the early development of the rural electric programs of the Northwest. Ben D. Moses of California was the spark plug for development work in that state.

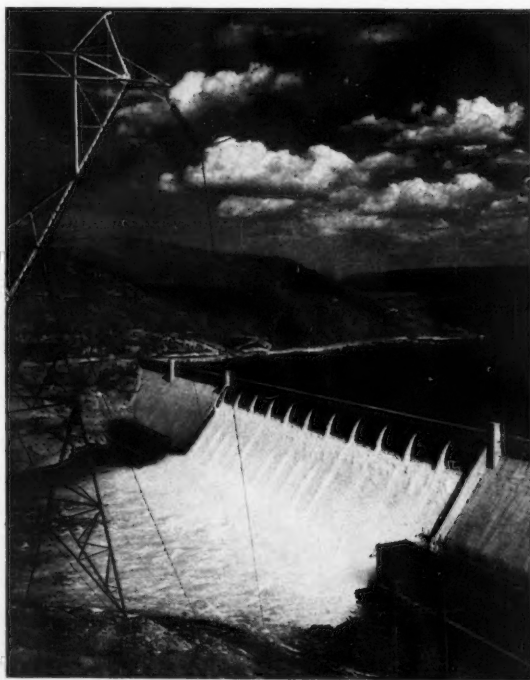
Research in rural electrification has continued without interruption both in times of depression and war in the state of Washington. There were minor interruptions in the other two states, but rural electrification has progressed steadily in the Pacific Northwest for nearly one-quarter century. Today, in addition to workers in the several land-grant colleges, the power companies of Idaho, Oregon, and Washington have men in the field helping farmers make better use of electricity and to assist in better farming practices generally. British Columbia should not be forgotten in this listing. Several men had become active in this field just previous to the World

War, in the valleys and territory adjacent to Vancouver, B. C.

In connection with the rural electrification research by the three northwestern state committees, progress reports were prepared annually together with bulletins and circulars, often in mimeographed form. For a time, Ben Moses and George Kable competed in the matter of turning out special mimeographed reports on new developments in rural electrification. Hobart Berresford started a very fine series of leaflets, the most recent being one on the farm shop, by Howard Knight. The secretary of the Washington committee prepared nearly 50 brief articles in numbered series form of the northwestern farm magazines. The power company specialists, notably J. C. Scott of the Puget Sound Power and Light Co., got out some very fine publications on various rural uses of electricity. These and numerous radio talks and articles for the weekly press had a marked influence on developing greater rural use of electricity in the Northwest.

It is impossible to go back nearly 25 years and enumerate in detail the various important developments in rural electrifi-

(Continued on page 446)



A view of Grand Coulee Dam on the Columbia River in Washington. The present generating capacity of this hydroelectric power plant is one million kilowatts; it has a total potential capacity of two million kilowatts. There are nine turbines and generators in operation in the near powerhouse, the main room of which is five stories high

This is an address delivered at the annual meeting of the American Society of Agricultural Engineers at Portland, Ore., June, 1948.

L. J. SMITH is state professor of agricultural engineering, State College of Washington, Pullman.



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## Rural Electrification in the Pacific Northwest

(Continued from page 444)

cation in the Pacific Northwest. It will be necessary to confine my attention chiefly to the developments in Washington with which I am more familiar. In many cases, work along similar lines was being conducted in the other states.

Rural electrification is one of those developments which comes to a people or a nation once or twice during the lifetime of the individual. New ideas and practices, the applications of new inventions, often bring about changes in our very life practices. An excellent example is the development of cement and the use of concrete on a commercial scale which took place during the last twenty-five years of the 19th century. That period was indeed called the "Concrete Age." Concrete came into general usage, and even today it is the basis of all our great developments. We could not have had the atomic bomb nor the great hydroelectric developments of the Northwest without the use of concrete.

At the beginning of the present century the gas engine developed very rapidly, followed almost immediately by the automobile and the gas tractor. The gas tractor proved its worth in World War I when the American farmers were asked to greatly increase their production, not only for the United States and American soldiers, but also the Allies. Rural electrification is the third of these great recent developments which have proved of such importance to agriculture. As these developments take place, our national life steps on a higher plane. There is no turning back to the old ways.

### WASHINGTON HIGH IN RURAL ELECTRIFICATION

Washington ranked high in percentage of rural electrification among the states of the nation in the early '20's. About 35 per cent of the farms were connected to power lines. Some rural lines had been in operation for 10 to 15 years. A great many farmers, however, knew very little about the applications of electricity to agriculture. Electricity was not always used to the best advantage. Very little research had been done in this field. Thousands of other farmers were interested in rural electrification, but were not certain as to the need nor as to the value which might result from being connected to power lines in the state. Most farmers thought of electricity chiefly as a means of lighting their homes and farm buildings.

During the summer of 1925, fifteen representative rural lines were studied by Garver and Smith, securing data on all farms along these lines whether they were connected with electric lines or not. These studies furnished information in regard to agricultural conditions generally and the utilization of electricity in agriculture at that time. It was found that electricity was being used on Washington farms in 35 different ways, about half of which had to do with the farm home. It was also found that there was a great deal of interest in the possibility of using irrigation to supplement the limited summer rainfall, especially on farms west of the Cascades. At the time of these surveys, there was very little electric water heating or electric cooking except in the Palouse country in the vicinity of Pullman and Colfax. No electric refrigerators were found on any of the 300 or more farms visited. The curling iron, however, was in very common usage in a large number of the farm homes, also a high percentage of washing machines and electric irons.

The early studies of the investigators of the Washington C.R.E.A. had to do with irrigation, electric brooding and incubators, electric hotbeds, electric soil heating, rural line losses, stationary spray plants, silo filling, electric hay hoisting, sterilization of dairy equipment, night lighting of poultry laying houses, and the practicability of the milking machine. Continuity of service and standard line construction were very important items in connection with the earlier investigational work in rural electrification.

There was a general feeling that one could not produce milk of a low bacteria count when the milking machine was used. Studies by the Washington C.R.E.A. in representative areas of the state, however, showed that many farmers were producing milk of a low bacteria count, using the milking machine, which was a great labor saver on dairy farms, often dispensing with one hired man. These findings encouraged the use of power milkers.

(Continued on page 448)

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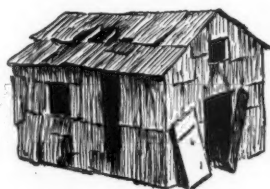
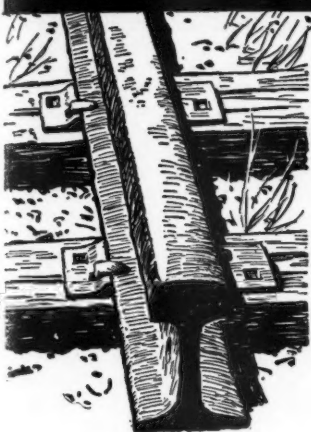
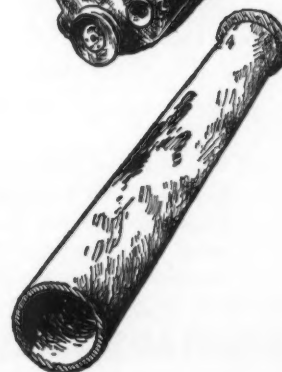
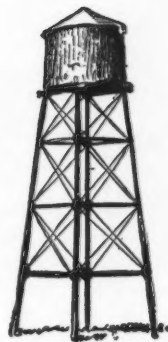
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## Rural Electrification in the Pacific Northwest

(Continued from page 446)

It was also found that many berry growers were of the opinion that berry bushes could not be sprinkled during the ripening period of the berries, fearing that such a practice would produce mildew. The studies of the investigators showed that such was not the case, and the berry growers were therefore encouraged to use the sprinkling system of irrigating which was a great labor saver and which definitely increased the yields. These findings were of value to agriculture generally throughout the United States.

There is not space to go into detail in connection with the various projects studied by the investigators of the Washington C.R.E.A., often with the cooperation of the branch experiment stations and the various divisions of the main experiment station. Over 100 projects were approved at the annual meetings of the committee and studied by the investigators during the past 23 years. Many of them had a very definite effect on agricultural practices, not only in the state of Washington, but of many areas of the United States. The investigational work on pig and lamb brooding, for example, was of great value to farmers generally, clear across the northern and north-central areas of the United States, especially during the recent world-wide conflict when food was so important in winning the war. Early refrigeration studies and basic experimental work on the fundamentals of lighting and brooding, dehydration, also the heating of water for stock and poultry, were of great value in many agricultural areas of the United States. In all, some 35 bulletins have been published as a result of our investigational program, and 24 progress reports.

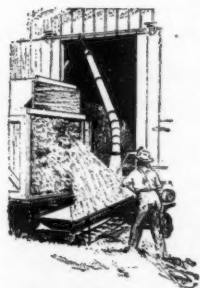
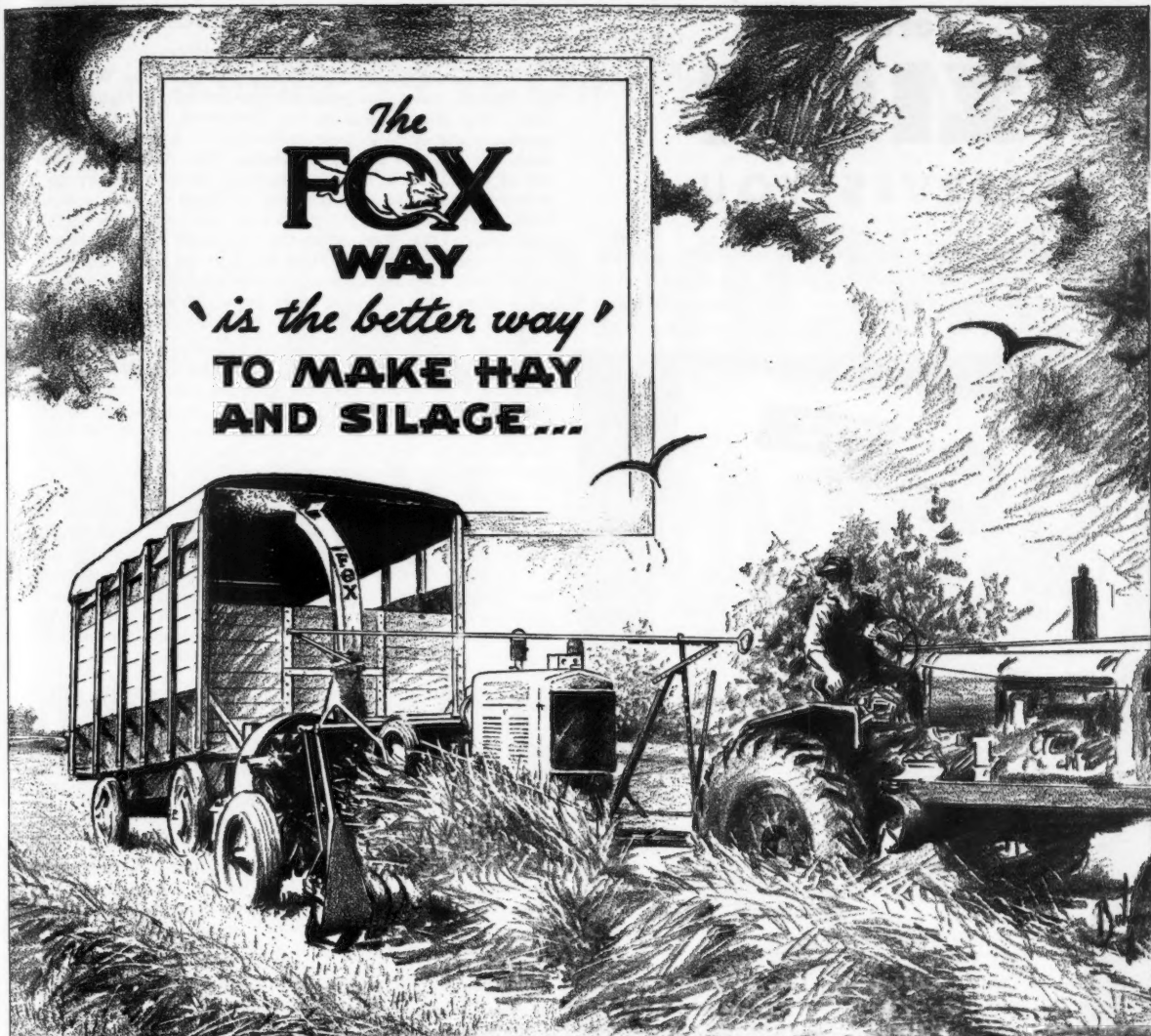
### AGRICULTURAL USES OF ELECTRICITY ARE MANY

In the fall of 1946, with the assistance of the utility field men and the heads of the departments in the college of agriculture, I made a listing of all known uses of electricity in the field of agriculture in the state of Washington. While we knew that, with our greatly diversified agriculture, electricity was serving the farmers—perhaps in 175, possibly 200 different ways—we were surprised to learn of more than 250 uses of electricity on the various farms in our state, running to 30 to 35 uses on a great many farms—as much as the total number of uses in 1925. Recent reports from Idaho and Oregon have increased this number somewhat. As might be expected, domestic uses lead with 53. The other groupings are as follows: Agronomy, 32; animal husbandry, 22; dairy, 20; farm shop, 22; floriculture, at least 10; horticulture, 22; irrigation, 3 to 4; poultry, 27 to 28; refrigeration, 3; motorized equipment, 17; miscellaneous, 24 to 25. Lights are in use in many farms. This will increase.

The electric motor is rendering great service to the agriculture of the Northwest. It is used in more than 150 different ways, from the electric clock to the larger motors for prune dehydration, irrigation, and hay drying. These uses, of course, run through the lists already mentioned. It is doubtful if any agricultural area in the union has such a wide diversity of uses of electricity in their rural areas.

It might also be well to summarize some other developments during the past 25 years. During this period rural electrification has expanded in the state of Washington from somewhat over 25 per cent until today 94.6 per cent of the farmers in Washington are connected to power lines. Oregon and Idaho also have nearly the same high percentages—92.2 per cent and 93.3 per cent, respectively, with California, 90.5 per cent. This is a tremendous development exceeded by only a few states in the Union. Practically all well-established farms and many farms of the marginal type are enjoying the benefits of electricity and at rates lower than other agricultural areas farther east. This also applies to Idaho, Oregon, and California.

In 1924-25, at the beginning of the investigational program of the Committee on the Relation of Electricity to Agriculture, electricity in the Northwest along rural lines cost around 3¼ cents per kw-hr, depending upon the amount used. There was usually a charge of 12 to 15 cents per kw-hr for the first 15 to 20 kw-hr, after which the rate was 3 cents. To any farmer, therefore, who was making a fair use of electricity, the cost ran somewhat over 3 cents per kw-hr. (Continued on page 450)



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## Rural Electrification in the Pacific Northwest

(Continued from page 448)

What is the situation in this period following World War II? Wages and prices generally are now much higher than in 1925. Yet the farmers in the Northwest, and also the city dwellers, are getting their electricity at a much lower rate than was the case a quarter century ago. A check in a number of typical rural areas of the state shows that any farmer making a fair use of electricity is doing so with a rate of little more than one cent per kw-hr—less than one-third the rate charged 25 years ago. On the other hand, during this quarter century prices have doubled in all other fields. It is doubtful if the user of electricity is securing any commodity other than electricity at a price anywhere near equal to that charged in the early '20's.

What has happened in regard to the amounts of electricity used in the field of agriculture in the past 25 years? Recently I went back into the early records on monthly electrical energy consumption along rural lines studied in 1925, to secure the amounts of electricity used in typical agricultural areas of that time, and to compare that data with the electrical energy consumption along these same lines in 1946, 22 years later. These comparisons are very interesting. For example, a study of the rural line immediately north of Outlook, Washington, one of the better rural lines in the Yakima Valley in 1925 and one of the few lines that had been in use for 12 years at that time, showed an average monthly electrical energy consumption of only 37 kw-hr, only four of the users on this line having an electric range. This was in 1924. The average electrical energy consumption in 1946, however, was 433 kw-hr—an increase of over 1100 per cent.

### ELECTRICAL ENERGY CONSUMPTION FIGURES

One of the oldest rural lines in western Washington was also checked. It was a short line just south of Lynden, Washington, close to the Canadian border. It had been in use for 10 years at the time of the 1925 survey. This line served chiefly dairy farmers and should have had a fairly large electrical energy consumption in 1924. Most of the farmers were of Pennsylvania Dutch origin, and were they thrifty! While they all had electric irons and washing machines, they did not use their irons if there was heat in the kitchen stove. The average monthly use on this line was somewhat less than 50 kw-hr, a good figure for that time. In 1946 the average monthly electrical energy consumption had risen very close to 310 kw-hr per month.

Another line just north of Puyallup was checked. The farmers served in this area had small acreages of berries and vegetables. Quite a number of them were poultrymen. With these small farms, one would not naturally expect a very large use of electricity. Though the line had been in use for three or four years, the average monthly use in 1924 was only 30 kw-hr. In 1946, however, the average amount used per month was very close to 245 kw-hr.

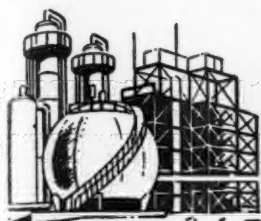
A new line just erected south and east of Battleground in Clarke County was selected in 1925 as being representative for the agriculture in that part of the state. Since the farmers were not at all used to the benefits of electricity, it is doubtful if they were using more than 25 to 30 kw-hr during the first months after being connected. In 1946, however, the average monthly consumption was very close to 630 kw-hr. The farmers along this line are prosperous, have fairly large farms, and are using electricity in a large variety of ways, often from thirty to forty.

In the Palouse country of eastern Washington, the farmers on a rural line several miles west of Pullman were making excellent use of electricity. This was largely because about one-third had installed electric ranges and water heaters. Incidentally, the territory served by the Washington Water Power Company pioneered in electric cooking. In 1924, these farmers were using nearly 500 kw-hr monthly. In 1946, this figure had increased to 730 kw-hr. Many farmers in the Palouse country of eastern Washington and northern Idaho use 900 to 1000 kw-hr of electricity per month, the highest use usually being in the summer. The percentage increase on this line during the past 22 years has not been as great as on other lines, chiefly due to their early and greater use of electricity for cooking and water heating in the home.

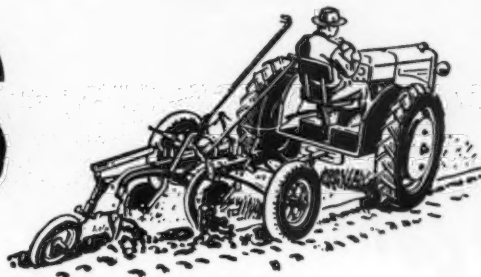
(Continued on page 452)

*October 14 is Oil Progress Day!*

.....



# **OIL PROGRESS MEANS TRACTOR PROGRESS**



*Tractors are far more efficient today than they were in 1935.*

There are many reasons for this great advance—but one important reason is the modern, high octane gasoline that has made possible today's high compression engines.

*The number of tractors on farms has increased 59% since 1941.*

Good designing, manufacturing and selling by tractor people have speeded this growth. But, remember, the convenience, power and economy of gasoline have helped to win over the farmer.

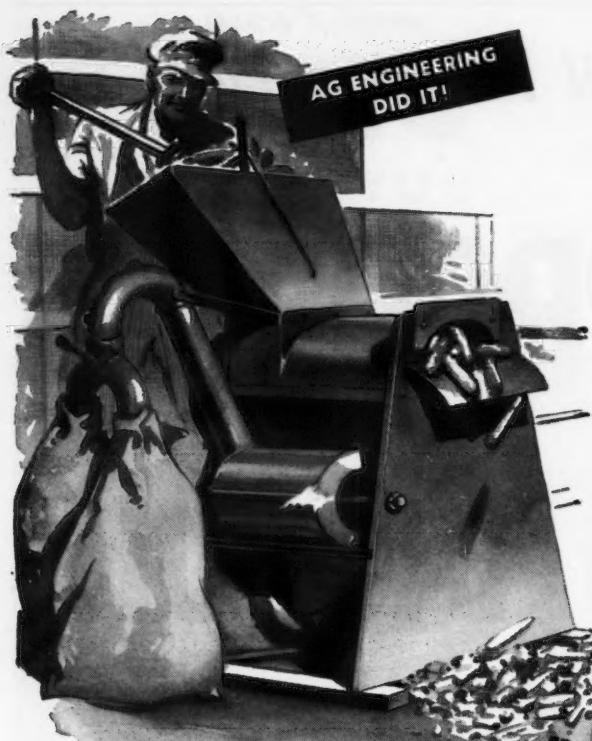
*Tractors are now working 20% more days than before the war.*

That's a tribute to the part the tractor industry has played in feeding the world. But don't forget that this extra operation depends on today's tremendously stepped-up output of petroleum products.

The petroleum industry has designated October 14 as Oil Progress Day—and farm machinery men will recognize the meaning of the day, for they have taken advantage of progress in petroleum to give America the most efficient farm power in the world.

## **ETHYL CORPORATION**

**CHRYSLER BUILDING, NEW YORK 17, N. Y.**



**CORN**  
*"comes clean"*



**H**OT, buttered roastin' ears! You can sink your teeth into an ear and clean it off in jig time. But ... not as fast and not as clean as today's shellers can whiz through a bushel of field corn.

Corn husking and shelling used to steal plenty of time from a farmer's work day. A long, hard job if there ever was one.

But along came shellers and husker-shellers ... to do in a few easy minutes what took hours before. These were machines engineered by men who know the farmer's problem ... and know what to do about it.

And these engineers didn't stop there. They kept adding improvements. Picker fingers which husked the cob clean. A fan to blow husks clear of the machine. And the adjustable baffle in the sheller to get every kernel ... eliminating the old style vibrating shaker.

Whether it's a brand-new machine to do an old job ... or improvements to make a present one work better ... the agricultural engineer has a big hand in it. By showing manufacturers what the farmer needs in machinery ... and helping the farmer make the best use of mechanization.

**NEW HOLLAND MACHINE COMPANY**  
 New Holland, Pennsylvania



**NEW HOLLAND**  
 FARM ENGINEERED MACHINERY FOR BETTER FARMING



## Rural Electrification in the Pacific Northwest

(Continued from page 450)

One may naturally ask, "What about the future of rural electrification?" Have the farmers in the Northwest made as much use of electricity as they ever will make, or will the rural uses and the rural electric load increase? I have been in rather close touch with rural electrification during these many years, and I cannot but feel that, generally speaking, there will be a continued increase in the use of electricity in most agricultural areas. The amount of increase will depend on the type of agriculture, the size of the farm, also the prosperity of the farmer. It is to be expected that there will also be additional economic agricultural uses of electricity.

The main reason for feeling that there will be an increased use of electricity in agriculture is that the farmer must, in the last analysis, compete with the worker in industry, so far as the purchasing power of his dollar is concerned. If the farmer is not as efficient, if his farm organization and practices are not as well set up, and if the farmer does not make the best possible use of power and other labor-saving facilities, he is definitely at a disadvantage as compared to the industrial worker.

### USES OF ELECTRICITY IN AGRICULTURE WILL INCREASE

Generally speaking, the standard of living of those employed in industry depends largely on the effective use of power and labor-saving equipment. The American farmer of today, with the exception of the grain farmer, is at a marked disadvantage as compared to the industrial worker in this respect. He does not use so much power nor is he so well equipped with labor-saving equipment or well-developed efficiency practices.

As the farmer becomes more aware of the type of competition that he is up against, he will naturally be more and more inclined to use greater amounts of power and all types of labor-saving devices. This will mean a greater use of electricity in the field of agriculture—not a great increase perhaps in the use of electricity in the farm home but a much greater use of electricity around the farmstead and in the various farm buildings. All this means that the farmer of tomorrow will be using a greater amount of electricity than the farmer of today. Just what the percentage increase will be, no one can tell, but it is easy to visualize an increase of one-fourth or one-third in the electrical energy consumption on most of the farms in the Pacific Northwest.

Research in rural electrification, the development of better electrical equipment, the working out of better practices, the publication of articles and bulletins on rural electrification, and the field work of the extension specialists (state, federal, and utility)—these agencies have helped develop and put rural electrification on a sound permanent basis. All of these agencies will contribute toward increasing the electrical energy consumption in agriculture and making the work of the farmer lighter and living on the farm more satisfying in the years ahead.

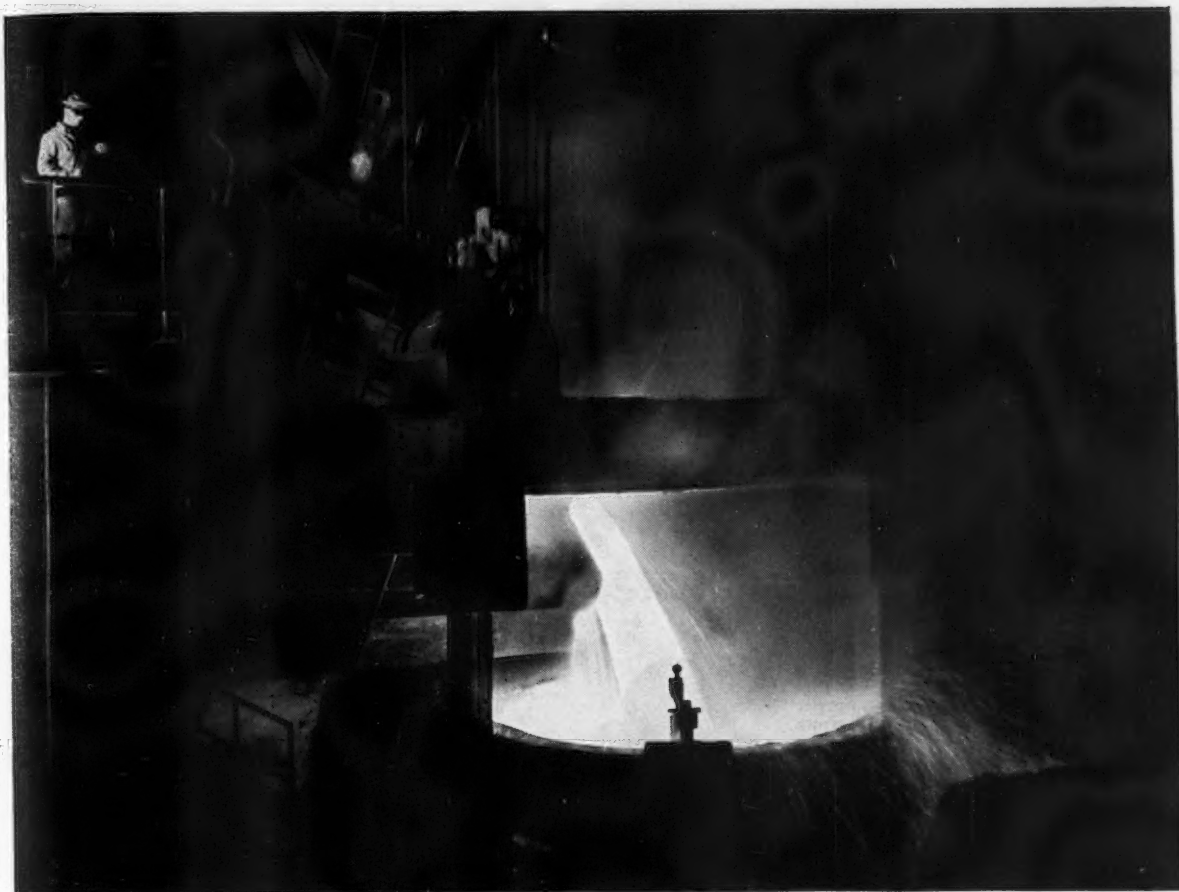
## Increasing Farm Product Use Values

(Continued from page 423)

In fact, it is Mr. Yerkes who has suggested a means of expediting much needed research in this field by increased use of available modern spectrographic equipment for analysis of soil samples. It appears that his suggestion will gain considerable support and may lead to early action.

Quantitative results of this research would provide a foundation for further agricultural engineering development of operations and operating equipment to enable farmers to produce and deliver greater food values and other use values in their products.

We do not urge that agricultural engineers attempt to invade the technical fields of biochemistry and nutrition. We do believe that continuing progress in these fields can be anticipated, and furthered by agricultural engineering cooperation. It seems logical that agricultural engineers should stand ready to help, with every engineering means at their command, in the biochemical approach to improved farm product use values.



## 70 tons of better health

It's a spectacular sight — 70 tons of white-hot stainless steel gushing out of a giant electric furnace. But there is much more to it than you can see here.

The health of the farm family and the nation is safeguarded in hundreds of ways by stainless. In the dairy barn, in giant food-processing plants, in big laboratories that make the new lifesaving drugs and in farm homes, bright stainless steel protects health because it is so easy to keep sanitary.

There are dozens of practical uses for stainless in products for the farm. Among them are spotless milk pails, milking machines and cream separator parts, and other dairy equipment; sprayers, poultry

pickers and combustion chambers for crop dryers.

Alert manufacturers of farm machinery and equipment are turning to this rustless steel because it gives their products greater beauty, strength and durability, and saves the farmer money through longer service.

Armco makes more than 60 grades of stainless steel. With stainless, as with the many other extra-quality Armco Steels, the famous triangle on a product tells the farmer the manufacturer has chosen a steel developed especially to give him long service at low cost. That's why so many farmers look for this Armco trademark when they buy. Armco Steel Corporation, 487 Curtis Street, Middletown, Ohio. Export: The Armco International Corporation.

**ARMCO STAINLESS STEELS**



## 2 points to remember when selecting Spray Nozzles for Weed Killing equipment ... Pest Control ... Residual Spraying of Farm Buildings ... and Livestock Spraying

1. You'll want to specify the Spray Nozzles that give the essential performance characteristic of uniform distribution without excessive atomization in every low gallonage capacity ... down to as little as two or five gallons per acre.

**Only Spraying Systems  
TEEJET  
SPRAY NOZZLES**  
can provide such performance



2. You'll want to specify the Spray Nozzles you can depend on to perform exactly to specifications ... so that equipment can operate with proper efficiency ... so that concentrate coverage will be low in cost ... so that your customers will be 100% satisfied.

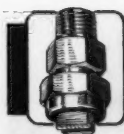
**Only Spraying Systems  
TEEJET  
SPRAY NOZZLES**  
can provide this accuracy



### SPRAYING SYSTEMS TEEJET SPRAY NOZZLES

For Weed Killing ... pest control, residual spraying of farm buildings, livestock spraying, orchard spraying, and whitewash or coldwater paint spraying ... for use on spray rigs or hand sprayers. Designed for uniform distribution of all low gallonage concentrate sprays.

TEEJET spray nozzles built with interchangeable orifice tips to meet all capacity requirements from 2 to 100 gallons per acre and up for Weed Killing sprays. All TEEJET nozzles are supplied with large built-in sealed-edge strainer, with monel metal screen. Write for complete information. If you'll send us the specifications on the spraying equipment you manufacture we'll be happy to supply our recommendations without obligation



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THE WORLD'S LEADING DESIGNER AND MANUFACTURER OF SPRAY NOZZLES

## NEWS SECTION

### A.S.A.E. Meetings Calendar

October 21 and 22 — PACIFIC NORTHWEST SECTION, Columbia Gorge Hotel, Hood River, Ore.  
October 23 — MICHIGAN AREA SECTION, Toledo, Ohio.  
November 12 and 13 — PENNSYLVANIA SECTION, Lewiston and State College, Pa.  
December 13-15 — WINTER MEETING, Stevens Hotel, Chicago.  
January 31 to February 2 — SOUTHEAST SECTION, Louisiana State University, Baton Rouge, La.  
June 20 to 23 — ANNUAL MEETING, Michigan State College, East Lansing, Mich.

### A.S.A.E. Winter Meeting Program

THE Power and Machinery, Farm Structures, Rural Electric, and Soil and Water Divisions of the American Society of Agricultural Engineers have each scheduled two to three days of sessions for the Society's Winter Meeting, to be held at the Stevens Hotel in Chicago, December 13, 14, and 15.

A possible new record attendance is indicated by increased interest on the part of agriculture's public service agencies and its service industries, by increase in ASAE membership and in personnel actively employed in agricultural engineering, and by the efforts of division chairmen to schedule topics of particularly timely interest.

#### POWER AND MACHINERY PROGRAM

A panel discussion on "Chopped Forage Handling Equipment" is scheduled for the opening session of the Power and Machinery Division, Monday morning, December 13.

F. W. Duffee, chairman of the agricultural engineering department, University of Wisconsin, is to cover "Length-of-Cut Problems with Flywheel-Type Field Choppers." E. L. Barger and J. B. Liljedahl, professor and assistant professor of agricultural engineering at Iowa State College, are to report "Results of Ten Years of Experimentation on Mechanical Unloading of Chopped Forages." Other subjects tentatively scheduled for consideration by the panel include "Problems in the Design of Forage Blowers," "Forage Wagons as All-Purpose Farm Wagons," and "A Farmer's Experience and Suggestions on the Problems of Handling Chopped Forages."

Equipment for weed control is to receive the full attention of the afternoon session. "A Regional Program for Testing Weed Control Equipment" is the subject of a progress report to be made by R. A. Norton and R. E. Larson, Jr., agricultural engineers in the U. S. Department of Agriculture, and by V. H. Johnson, division of agricultural engineering, University of Minnesota. O. B. Wooten, Jr., of the U. S. Department of Agriculture, is to report on "The Development of Equipment for Applying Herbicides, Defoliant, and Insecticides for Southern Farm Crops." Additional tentatively scheduled subjects include "An Appraisal of Present Developments of Chemicals for Weed Control," "Design and Performance Requirements of Equipment for Spraying Corn Borer," and "Airplane Spraying of Rice and Cotton."

Problems in the mechanical design of farm equipment will be featured on Tuesday, December 14, with a morning session on stress analysis, and an afternoon program on bearing applications.

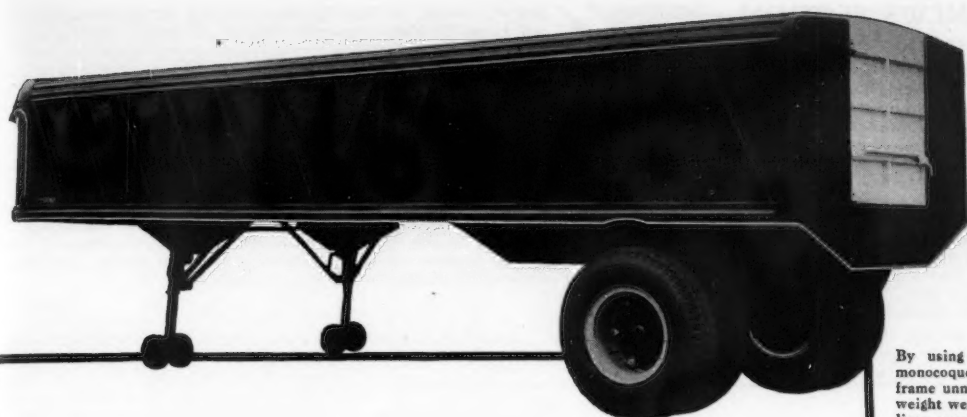
Dr. Charles Lipson, consultant on stress analysis, has been secured to open the subject with a contribution on "Organizing for Experimental Stress Analysis of Farm Machines." This is to be followed by papers on "Stress Analysis by Electrical and Mechanical Strain Gages," "Stress Analysis by Brittle Coating," and "Stress Analysis by Photoelasticity."

In the bearings session, J. L. Haynes, of the Hyatt Roller Bearings Division, General Motors Corp., is to cover "Straight Roller Bearings." R. J. Lynch, New Departure Division, General Motors Corp., will cover "Sealed Ball Bearings." B. T. Virtue, assistant chief engineer, bearings division, The Torrington Co., will represent "Needle Bearings" on the program. "Tapered Roller Bearings" will also be covered according to tentative plans.

On Wednesday morning, December 15, attention will be turned to hydraulic controls. The session is to open with a presentation on "The Development of Hydraulic Control Systems for Farm Implements," by J. F. Ziskal, International Harvester Co. K. W. Anderson, research engineer, Deere and Co., is to present "The John Deere Systems of Hydraulic Control." This is to be followed by a "Progress Report on Standardization of Hydraulic Controls for Farm Equipment," by E. W. Tanquary, engineer, International Harvester Co.

Tractors and traction will be the theme of the Division's closing session, Wednesday afternoon, "Engineering Development of the Allis-Chalmers Model 'G' Tractor and Related Implements" is to be reviewed by C. T. O'Harrow, Tractor Division, Allis-Chalmers Mfg. Co. A contribution on "The Development of a Self-

(Continued on page 436)

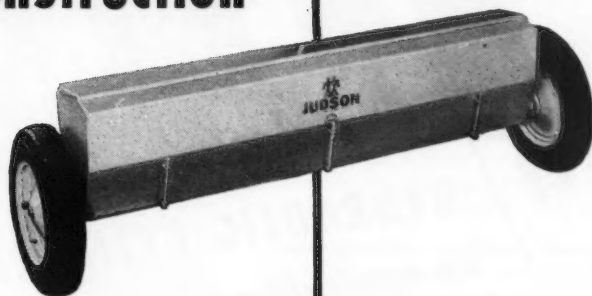


800 lb. of weight saved in this 30 ft. grain trailer — by using U-S-S COR-TEN in place of carbon steel — means less dead weight to pull, more payload capacity, long-lasting, durable construction. It also means low manufacturing costs and a saving in steel tonnage used.

Strong, lightweight, corrosion-resisting

## COR-TEN construction

- Benefits the farmer
- Benefits the manufacturer
- Benefits the country



By using U-S-S COR-TEN in a monocoque design which makes a frame unnecessary, 300 lb. of dead weight were trimmed off this fertilizer spreader. Says the manufacturer: — "By reducing the weight, almost one-half, we reduce the power required to operate the machine. COR-TEN also gives our product a much greater resistance against impact, abuse and corrosion. Where highly corrosive fertilizers are used, COR-TEN's high corrosion resistance certainly pays off."

**I**N U-S-S COR-TEN, the pioneer high-strength steel, farm implement manufacturers have found the ideal material for improving agricultural equipment — to boost its productive capacity, to reduce repairs and maintenance to a minimum.

### The farmer gets more for his money.

U-S-S COR-TEN's high strength — 50% greater than plain carbon steel, based on yield point — makes substantial weight savings possible. Light weight pays off in reduced operating costs, in increased capacity to do work. COR-TEN's greater resistance to fatigue, abrasion, and impact insures added stamina and ruggedness. And because COR-TEN has 4 to 6 times greater resistance to atmospheric corrosion than plain

steel, its use puts the farmer far ahead in his ceaseless battle against rust and corrosion — the chief destroyer of farm equipment.

### The manufacturer stretches his steel supply.

By using U-S-S COR-TEN in thinner stronger sections to replace carbon steel, the farm implement builder can reduce the weight of his units as much as one-fourth—can give his

customers lighter, stronger and more durable products—and get as much as one-third more units from every ton of steel . . . generally at little or no increase in cost.

Write us for the U-S-S COR-TEN story. Our engineers have had more than twelve years' experience in applying this superior steel to mobile equipment of all types. They'll be glad to show you how COR-TEN can be used to give you maximum benefits at minimum cost.

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 TENNESSEE COAL, IRON & RAILROAD COMPANY, BIRMINGHAM  
 UNITED STATES STEEL SUPPLY COMPANY, WAREHOUSE DISTRIBUTORS, COAST-TO-COAST  
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UNITED STATES STEEL

## NEWS SECTION

(Continued from page 454)

Propelled Farm Power Unit has been tentatively scheduled. "The Use of Soil Tillage Plots for Testing Farm Tractor Tires," is to be opened by I. F. Reed, senior agricultural engineer, Soil Tillage Laboratory, U. S. Department of Agriculture.

### FARM STRUCTURES PROGRAM

In starting its sessions on Tuesday morning, December 14, the Farm Structures Division will give attention to certain building materials. Papers scheduled include "Results of Research Studies of Lightweight Aggregates," by E. G. Molander, senior agricultural engineer, U. S. Department of Agriculture; "Vermiculite Insulating Concrete for Animal Shelters," by Harvey W. Steiff, agricultural engineer, Western Mineral Products Co.; and "Fire Tests of Building Materials and Equipment," by N. H. Davis, Jr., Underwriter's Laboratories, Inc.

In the afternoon Wallace Ashby, head of the farm building and housing division, U. S. Department of Agriculture is to present a "Re-

port of a Survey on Farm Building Activity." Henry Giese, professor, and Elwin D. Palmer, graduate student, agricultural engineering department, Iowa State College, are to report recent research data on "The Application of Glue in Framing Farm Buildings." Deane G. Carter, professor of agricultural engineering, University of Illinois, will present an engineering viewpoint on "Some Problems of Farm Building Management."

"Controlled Ventilation of Dairy Barns" by C. N. Turner, associate professor of agricultural engineering, Cornell University, is the first item on the Wednesday morning program. It is to be followed by a related subject, "Heat Exchanger Application in Dairy Barn Ventilation," by C. G. E. Downing, head of the agricultural engineering department, Ontario Agricultural College. A review of nation-wide farm housing research will be presented by J. Robert Dodge, agricultural engineer, U. S. Department of Agriculture.

### GRAIN DRYING PROGRAM

The Farm Structures and Rural Electric Divisions on Wednesday afternoon, December 15, will jointly sponsor a grain-drying program.

"Progress in the Mechanical Drying of Corn" is to be summarized by C. C. Shedd, agricultural engineer, U. S. Department of Agriculture.

"Basic Drying Rates for Different Grains" are to be reported by G. E. Page, agricultural engineering department, Purdue University, and by L. E. Holman, agricultural engineer, U. S. Department of Agriculture.

"Results of Moisture Equilibrium Studies in Crop Conditioning and Storage," will be presented by J. W. Simons and O. E. Cross, agricultural engineers, U. S. Department of Agriculture and the University of Georgia. Further proposed contributions to this session are still pending.

### RURAL ELECTRIC PROGRAM

At this writing the rural electric sessions are still in more tentative form, with confirmations still to be received from most of the proposed speakers.

A session on heating is planned, with consideration to be given to electric panel radiant heating, the heat pump, milkhouse heating, off-peak water heaters, and heat lamps.

Radiation subjects indicated for another session include "Production and Measurement of Different Wave Lengths of Light," "The Use of Light in Stimulating Plant Growth," "The Use of Ultraviolet Lights for Germicidal Processes," and "Agricultural Use of Supersonic Radiation."

Wiring is to be featured in a third session, with contributions tentatively scheduled on "Pole Metering and Underground Distribution," "Remote Control Wiring for Farms and Farm Homes," "Automatic Controls for Ventilation of the Common Storage," and "Phone Dial Control of Farm Operations."

Other subjects tentatively scheduled include "The Thermocouple in Agricultural Research," "Automatic Grinding of Ear Corn," "Rural Electrification in North America," a picture of the situation obtained by a six-month travel study, "Testing and Development of Electrical Products for Farm Use," and "Better Methods in Use of Electricity."

### SOIL AND WATER PROGRAM

The plan for sessions of the Soil and Water Division has not yet been released by the chairman, but he has an abundance of suggestions from which to build a full program, offering new and interesting reports on various aspects of drainage, irrigation, soil and water conservation, and farm reservoir construction.

A special session of College Division members is also being planned to be held during some available period during the three days.

Copies of the final program and other information about the ASAE Winter Meeting will be sent on request to ASAE, St. Joseph, Michigan.

(News continued on page 458)



**B**ENDIX-PACIFIC now is in production on this line of agricultural cylinders. These cylinders have been specifically designed to meet the standards of the Farm Equipment Institute and are being used by several tractor manufacturers.

Through the use of seamless tubing and advanced manufacturing techniques these cylinders are lighter in weight and cleaner in design, materially aiding in the lifting, handling and attaching required in their use. The heads are designed so that they can be rotated to any position, permitting plumbing connections to be made from any side or angle.

These cylinders are competitively priced. They can be furnished with mechanical or hydraulic depth stops.

Bendix-Pacific also is building many other types of cylinders and offers its engineering facilities to assist with your cylinder design requirements, or will quote on designs to your specifications. In the past eleven years this company has built more than 100,000 hydraulic cylinders of all types . . . this extensive experience and manufacturing know-how can produce reliable low-cost cylinders for you.

Detailed information will be gladly furnished on these cylinders and other Industrial Hydraulic Equipment on request.



PACIFIC DIVISION, BENDIX AVIATION CORPORATION  
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Sales engineering offices in New York and Chicago



**1. FULL BITE** beats costly slippage. Unique, flat tread spreads tractor weight evenly from shoulder to shoulder, forces lugs to take a deeper, stronger grip. Makes faster work of *any* job on *any* soil.

**2. LOCKED LUGS.** The U. S. Royal "Backbone" braces lugs against costly layback that so often scuffs tread away. U. S. Royals add years to ordinary tractor tire life.

**3. SMOOTH-RIDING BACKBONE SURFACE** lasts longer on highway or hard ground. Prevents scraping, scuffing, wasteful wear. Cuts tractor tire costs even more.

## These 3 extra features pay off in permanent profits for you!

**They make it easy to demonstrate and sell the extra quality**

**U. S. ROYALS**

Yes, there's good profit in selling the U. S. Royal Tractor Tire. But its advantages go far beyond that. Its *extra* features—its *extra* quality—build your business today *and* tomorrow. Like every U. S. Royal, it offers you *satisfied* customers, *lasting* customers, permanent profits and security. U. S. Royals are sold only through independent dealers.

**U. S. ROYALS by U. S. RUBBER**





# WHEELS

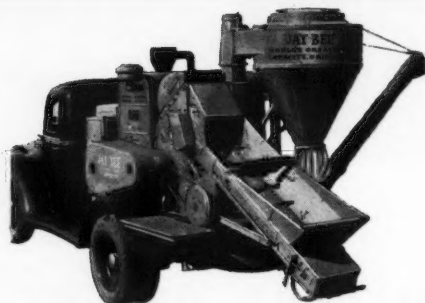
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**SIZES,  
TYPES and QUALITY  
for EVERY DUTY**

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DIVISION  
KELSEY-HAYES WHEEL COMPANY  
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Wheel Builders Since 1888

The  
Big Capacity

**JAY  
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## Portable Grinder

*Brings Modern Efficiency to the Farm*

The modern farmer and feeder gets speed, surprising economy and quality grinding by calling in the operator of a JAY BEE Portable grinder . . . to grind all grains and roughage right in his feedlot. He gets grinding exactly to suit his needs, and concentrates mixed in, if he wishes.

JAY BEE portables, noted for big capacity, speed, durability and convenience are the result of over a quarter of a century of mill making experience.

The JAY BEE Portable also offers splendid opportunity for an operator to go into a pleasant, profitable business of his own, serving farmers and feeders.

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details

**J. B. SEDBERRY, Inc.** Dept. K, Franklin, Tenn.

## NEWS SECTION

### Electrification Conference Program

"MEETING Farm Families' Needs Electrically" will be the theme of the 3rd National Farm Electrification Conference, to be held at the Congress Hotel in Chicago, November 17, 18, and 19.

George A. Rietz, program chairman, has arranged sessions devoted primarily to non-engineering aspects of rural electrification, many of which, however, are of interest to agricultural engineers in electrification work. Several of the speakers, and session chairmen will be recognized as members of the American Society of Agricultural Engineers.

Frank E. Watts, president of the Conference, will call the conference to order and introduce the opening speaker, Dean H. P. Rush of the University of Illinois, who will address this group on "The Place of the Extension Service and Agricultural Colleges in Rural Electrification." At the same session C. D. Leiter will lead a group report on the "Ashland, Ohio, County-wide Farm Electrification Demonstration."

In the afternoon session several farm wives are to report on "Changes Electricity Has Brought About on Our Farm and in Our Community." They will be followed by a panel on "How Power Suppliers Help Meet Farm Families Electrical Needs," with K. H. Gorham presiding. John Strohm, well-known writer on agricultural conditions, will address the Conference during this session on "Modern Agriculture Here and Abroad."

The second day will open with a panel on "How Home Economists Should Help Meet the Electrical Needs of Farm Families." During the same session L. M. Knox will address the Conference on "Operating My Farm Before Electrification and Now," and A. W. Turner, who heads agricultural engineering research in the U. S. Department of Agriculture, will speak on "The Importance of Newly Developed Methods to Process and Store Farm Crops."

In the afternoon session Mrs. Charles W. Sewell, administrative director, Associated Farm Women, will talk on "What Farm Women Have Been Getting From Their Electric Service and What More They Can Reasonably Expect."

Following a recess there will be a panel on "How Dealers Should Meet The Farm Families' Electrical Needs."

Friday morning, Robert H. Reed, editor, "Country Gentleman," will lead a panel on "How the Farm Press and Radio Should Meet the Electrical Needs of Farm Families." Another feature of this session will be an address on "The Importance Young Farmers Place Upon Full Employment of Electric Equipment on the Farm and in the Home."

The Conference will be brought to a close with a luncheon Friday noon.

### British Agricultural Engineers Send Greetings

GREETINGS from the Institution of British Agricultural Engineers were presented to the North Atlantic Section of the American Society of Agricultural Engineers during its meeting at Guelph, Ontario, Canada, September 8 to 10. They were expressed in a letter from Dr. Cornelius Davies, as follows:

"As President of the Institution of British Agricultural Engineers, I am asking my colleague and Vice-President, Mr. F. E. Rowland, to convey to you the hearty greetings of the Council and members of the British Institution and to wish you all success at your conference and continued prosperity for your Institution."

Some of the Members of Council of the British Institution have had the opportunity of meeting your members in the United States and have come away with very pleasant recollections of such meetings, and some of us in Great Britain have had the pleasure of meeting your members when they have visited our country, and we have greatly valued such contacts. Your Institution, of course, is older than ours, and it was the work that you had done, and the interest which you created amongst agricultural engineers in England that led to the formation of our own Institution. We greatly value the cooperation that exists between the members of the two bodies and I am asked by my Council to send you our best wishes."

The Institution held its annual luncheon in London, July 27. In his remarks as president on that occasion Dr. Davies raised the question, "Don't some designers need a little bit more education as to what farmers really need?" In discussing it he made a plea for more sound scientific engineering training for farm equipment designers, and encouragement of additional mechanical training for farm equipment operators and mechanics.

A recent memorandum from the Institution to the Joint Advisory Committee on Agricultural Education pointed particularly to the need of training additional operators and mechanics. The memorandum cited a need for 62,000 operatives and 2,500 agricultural mechanics for use directly on farms in the United Kingdom to improve the use and maintenance of farm equipment, thus paving the way for the further mutual progress of mechanization and farm production efficiency.

The proposed training for farm machinery operatives would cover power units, farm implements and machinery, and specialized machinery. For agricultural mechanics a part of the training would emphasize methods of dismantling, inspection, rectification or replacement, repair, reassembly, adjustment, and final testing.



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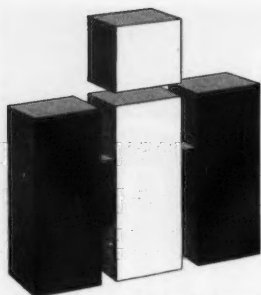
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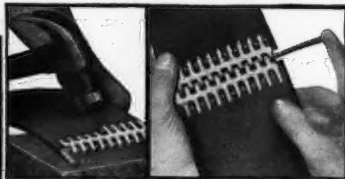
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## Necrology

**Elmer McCormick**, chief engineer, John Deere Waterloo Tractor Works, passed away suddenly in Milwaukee, Wis., September 11.

Mr. McCormick was born March 31, 1890, at Eylar, Illinois. He started work in the Deere organization in 1909, while a student at the University of Illinois, and continued on a full-time basis following his graduation in 1914. He was named sales manager of the Waterloo Gas Engine Co., when it was purchased by Deere and Co., and filled that position until transferred to the engineering department of the plant in 1928, as assistant chief engineer. He had been chief engineer of the plant since 1931.

A member of ASAE since 1920, he was also active in the ASME and the SAE, and represented the Deere organization on the engineering advisory committee of the Farm Equipment Institute. He was also a member of the First Presbyterian Church, BPO Elks Lodge 290, Waterloo Rotary Club, and Sunnyside Country Club.

Burial was at Odell, Ill. He is survived by his mother, Mrs. Louise McCormick; a sister, Miss Martha McCormick, and a brother Seth.

## Applicants for Membership

The following is a list of recent applicants for membership in the American Society of Agricultural Engineers. Members of the Society are urged to send information relative to applicants for consideration of the Council prior to election.

**Adams, Charles B.**—Junior engineer, New Holland Machine Co. (Mail) Esterly, Pa.

**Arnold, William E.**—Agricultural engineer, Soil Conservation Service, USDA. (Mail) Martin, Ga.

**Atwood, L. M.**—Western division manager, V-belt dept., Boston Woven Hose and Rubber Co. (Mail) 400 A Ave., N.E., Cedar Rapids, Iowa.

**Beach, William E.**—Research fellow in agricultural engineering, Iowa State College, Ames, Iowa.

**Bland, Byron L., Jr.**—Graduate student in agricultural engineering, Alabama Polytechnic Institute, Auburn, Ala. (Mail) 10-C Graves Apts.

**Bloodworth, Morris E.**—Irrigation and drainage engineer, Texas Agricultural Experiment Station. (Mail) P. O. Box 344, Mercedes, Tex.

**Boll, John H.**—Technical writer, Dearborn Motors Corp., 15050 Woodward Ave., Detroit 3, Mich.

**Camp, Joe B.**—Agricultural engineer, Soil Conservation Service, USDA. (Mail) Pecos, Tex.

**Collins, W. F.**—Product design engineer, McCormick Works, International Harvester Co., Blue Island and Oakley Aves., Chicago 8, Ill.

**Denniston, W. L.**—Experimental design engineer, John Deere Harvester Works. (Mail) 2500½ 11th St., Moline, Ill.

**Ford, James H.**—Agricultural engineer, application and loans div., Rural Electrification Administration, USDA. (Mail) 4846 9th St. N., Arlington, Va.

**Frey, Edwin D.**—Assistant engineer, S. L. Allen & Co. (Mail) 227 N. Bowman Ave., Merion, Pa.

**Gallagher, George L.**—Graduate assistant in agricultural engineering, Michigan State College, East Lansing, Mich.

**Gunn, Clare A.**—Assistant professor of agricultural engineering, Michigan State College, East Lansing, Mich.

**Howell, James M.**—Utilization department manager, Tennessee Valley Electric Cooperative, Savannah, Tenn. (Mail) 107 S. Church.

**Hunt, Ernest H.**—Chief draftsman, Truman J. Mathews (Architect), Santa Fe, N. M. (Mail) 256 Staab St.

**Jones, Joseph K.**—Assistant agricultural engineer, national cotton mechanization project, Delta Branch Experiment Station, Stoneville, Miss.

**Jongedyk, Howard A.**—Assistant soil conservationist, Soil Conservation Service, USDA. (Mail) Agricultural Engineering Bldg., Purdue University, Lafayette, Ind.

**Keel, Merritt W.**—Agricultural engineer, Soil Conservation Service, USDA. (Mail) General Delivery, Crystal City, Tex.

**Kirk, Lawrence H.**—Technical representative, Sul-Tech Distributing Co., Inc. (Mail) 1520 E. 17th St., Long Beach 13, Calif.

**Mangold, Larry R.**—Salesman, Calhoun Buckner Co., San Antonio, Tex. (Mail) 178 Sweetbriar.

**Mattingly, John W.**—Sales and service engineer, Automatic Equipment Mfg. Co., Pender, Nebr. (Mail) Box 409.

**Metcalf, Victor B.**—Engineer, Great Lakes Steel Corp., Stran Steel div. (Mail) 745 Chrysler Bldg., New York, N. Y.

**Minard, Keith S.**—Experimental engineer, The Oliver Corp. (Mail) 608 Wisconsin, Charles City, Iowa.

**Olson, Carl O.**—Manager, pump and irrigation dept., Dickerson Machinery Co., W 423 First Ave., Spokane 8, Wash.

**Pinkerton, H. H.**—Market analyst, Dravo Corp., Liberty and Fifth Aves., Pittsburgh 22, Pa.

(Continued on page 462)



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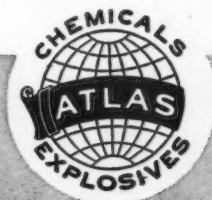
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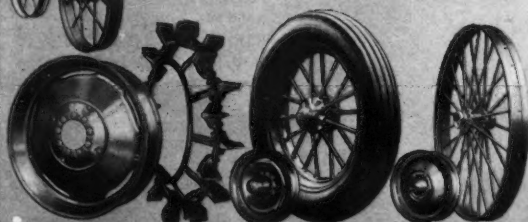
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## Applicants for Membership

(Continued from page 460)

*Paltbe, B. R. Van Wulfften*—N. V. Philips Gloeilampenfabrieken, Eindhoven, Netherlands. (Mail) Floralaan Oost 138.

*Pool, S. D.*—Research engineer, McCormick Works, International Harvester Co., Blue Island and Oakley Aves., Chicago 8, Ill.

*Pratt, Robert D.*—Instructor, veteran's agricultural training program, French Lick High School, French Lick, Ind.

*Preble, Norman H.*—Vice-president, implement div., Detroit Harvester Co., 2550 Guardian Bldg., Detroit, Mich.

*Roscoe, Merrill W.*—Assistant chief engineer, John Deere Spreader Works, 1209 13th Ave., East Moline, Ill.

*Rowland, F. E.*—Manager, agricultural dept., The General Electric Co., Magnet House, Kingsway, London, W. C. 2, England.

*Smith, Philip A.*—Instructor in farm machinery, New York State Agricultural & Technical Institute, Alfred, N. Y. (Mail) Box 162.

*Stewart, Robert E.*—Research assistant in farm structures, University of Missouri, Columbia, Mo. (Mail) R. R. No. 3.

*Taneja, Mohan L.*—Chargeman, Central Tractor Organization, Ministry of Agriculture, New Delhi, India. (Mail) 36 Naiwala St., Karol Bagh.

*Turner, George M.*—Instructor in agricultural engineering, Cameron State Agricultural College, Lawton, Okla. (Mail) R. R. 1.

*Vetter, Willard A.*—Instructor in agricultural engineering, New York State Agricultural and Technical Institute, Delhi, N. Y. (Mail) 51 Elm St.

*Warren, Clinton C.*—Owner and manager, Pump, Pipe & Power Co., 1624 S. E. Grand Ave., Portland 14, Ore.

*Williams, Homer C.*—Service engineer trainee, Foster Machinery Co., Albany, Ga. (Mail) 1408 Mimisa Dr.

*Wilson, Robert W.*—Assistant research professor of agricultural engineering, University of North Carolina, Raleigh, N. C.

*Woulfe, Murray T.*—Technical assistant, Jack Olding & Co., Ltd. (Mail) Flat 428, St. Ermin's Caxton St., Westminster, London, S. W. 1, England.

*Yeck, Robert G.*—Junior agricultural engineer, divisions of agricultural engineering, Bureau of Plant Industry, Soils and Agricultural Engineering, USDA. (Mail) 1313 Oakwood Pl., Middleton, Wis.

### TRANSFER OF GRADE

*Bates, Donald W.*—Extension agricultural engineer, Cornell University, Ithaca, N. Y. (Junior Member to Member)

*Melvin, Linn G.*—Cost engineer, John Deere-Killefer Co. (Mail) 2232 Jackson Ave., Wilmar, Calif. (Junior Member to Member)

*Owen, Robert R.*—Assistant plantations engineer, California Packing Corp. (Mail) P. O. Box 921, Wahiawa, Hawaii. (Junior Member to Member)

*Seal, Charles L.*—Owner, Seal Tractor Co., Woodville, Miss. (Junior Member to Member)

*Stafford, James P., Jr.*—Civil engineer, construction div., Vicksburg Engineer District, Corps of Engineers. Qtrs. 18 A-WES, Box 631, Vicksburg, Miss. (Junior Member to Member)

*Wilborn, E. D.*—Associate editor, Farm Implement News, 431 S. Dearborn St., Chicago 5, Ill. (Junior Member to Member)

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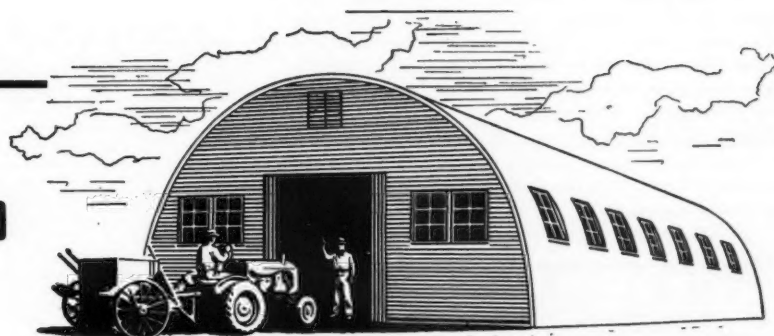
RATES: Announcements under the heading "Professional Directory" in AGRICULTURAL ENGINEERING will be inserted at the flat rate of \$1.00 per line per issue; 50 cents per line to A.S.A.E. members. Minimum charge, four-line basis. Uniform style setup. Copy must be received by first of month of publication.

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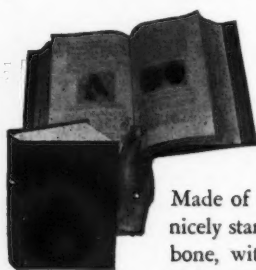
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This grower cultivating peas in California's Santa Clara Valley easily handles all crop growing chores with this new HUSKI Ridemaster garden tractor, built by the Food Machinery Corporation, San Jose, California. To the same unit he can attach an 8 inch plow, also a harrow and grader. Contributing much to the unit's over-all maneuverability and compactness—it turns in its own length—is the front-mounted Wisconsin, model AKS engine.

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## Personnel Service Bulletin

The American Society of Agricultural Engineers conducts a Personnel Service at its headquarters office in St. Joseph, Michigan, as a clearing house (not a placement bureau) for putting agricultural engineers seeking employment or change of employment in touch with possible employers of their services, and vice versa. The service is rendered without charge, and information on how to use it will be furnished by the Society. The Society does not investigate or guarantee the representations made by parties listed. This bulletin contains the active listing of "Positions Open" and "Positions Wanted" on file at the Society's office, and information on each in the form of separate mimeographed sheets, may be had on request. "Agricultural Engineer" as used in these listings, is not intended to imply any specific level of proficiency, or registration, or license as a professional engineer.

NOTE: In this Bulletin the following listings still current and previously reported are not repeated in detail. For further information see the issue of AGRICULTURAL ENGINEERING indicated.

POSITIONS OPEN: 1947 APRIL—O-552. 1948 JANUARY—O-605, 606. APRIL—O-612, 613, 615. MAY—O-617. JUNE—O-620, 621, 622. JULY—O-624, 626, 627, 629, 630. AUGUST—O-633, 634, 635, 636. SEPTEMBER—O-639, 640, 641, 642.

POSITIONS WANTED: 1948 JANUARY—W-137. MARCH—W-146. APRIL—W-158. MAY—W-169. JUNE—W-179. AUGUST—W-184, 189. SEPTEMBER—W-191, 192.

### NEW POSITIONS OPEN

**MANUFACTURING EXECUTIVE** to organize and direct production-manufacturing processes in Midwest plant of a manufacturer of grain and forage crop driers. Prefer man with mechanical or production engineering training and experience in engineering and shop fabrication of sheet metal products on short run or job shop basis. Should have ability to organize work and to direct other people. Opportunity for advancement to plant supervisory or superintendent position. Age 35 - 45. Salary \$4000-5500. O-643

**MECHANICAL DRAFTSMAN** (3 openings) to prepare production designs and drawings of farm implements in Midwest plant of large manufacturer. Prefer man with mechanical engineering training and considerable experience in mechanical drafting, particularly in farm implement field. Should be able to furnish good character references. Opportunities for advancement excellent. Company is growing rapidly and has plants across the entire country. Salary \$3000 and up. O-645

**MANAGER** of production and development, to redesign current products to cut costs and improve factory operation, and to be responsible for new product development, with small manufacturer of farm equipment. Location New York State. Want man with engineering degree, farm machinery production and development experience, and initiative to carry out assignment. Opportunity up to individual. Age 40 - 45. Salary open. O-646.

**AGRICULTURAL ENGINEER** (associate or assistant rank) for research in crop production, hay curing, etc., in new branch state agricultural experiment station in South. BS or MS deg in agricultural engineering, or equivalent. Usual personal qualifications for research in public service agency. Good opportunity for advancement. Housing and utilities furnished. House now under construction. Age 25 - 35. Salary open. O-647

**AGRICULTURAL ENGINEER** (associate professor) for full time teaching in soil and water conservation, irrigation, and drainage, in land grant university in the Southeast. MS deg in agricultural engineering, or equivalent, and teaching experience in this field. Usual personal qualifications for college teaching. Opportunity in growing department with new agricultural engineering building. Salary \$4200, nine-month basis. Additional pay if summer teaching required. O-648

### NEW POSITIONS WANTED

**AGRICULTURAL ENGINEER** desires design, research, or project work in power and machinery field, in private industry or public service. BS deg in agronomy, 1937, and MS deg in agronomy, 1943, University of Nanking. MS deg in agricultural engineering, 1948, Michigan State College. Currently graduate student, University of Illinois. Experience in research and teaching, in China, and as clerk in engineering department, Military Advisory Group, Nanking, China. No disability. Available, spring 1949. Married. Age 35. Salary \$500 per month in China; \$400 in U. S. W-193

**AGRICULTURAL ENGINEER** desires research, teaching, or extension work in farm machinery field, with public service agency or private industry. BS deg in mechanical engineering 1947; MS deg in agricultural engineering expected January 1949, University of Wisconsin. Wisconsin dairy farm background. Two summers as research assistant working on hay dehydration. One and one-half years as graduate assistant, teaching farm machinery, electrification and shop. War enlisted and commissioned service in Army Air Corps, with experience as instructor in flight engineering and maintenance on B-29. No disability. Available Feb. 1, 1949. Married. Age 27. Salary open. W-194

## New Literature

**EXPERIMENTS ON TRACTOR TIRE PERFORMANCE.** Paper, 24 pages, 7 1/2 x 9 3/4 inches. British Rubber Development Board (Market Buildings, Mark Lane, London, EC 3).

A summary report of results of tests for the Board at the British National Institute of Agricultural Engineering, during the summer and fall of 1947. Variables included four tire size, type, and rim combinations; four proportions of air and water inflation; and four traction surfaces. Results are presented in graphs and tables, with brief discussion, and include deflection curves, power transmission, slippage, sustained pull, and incidence of sidewall wrinkling. Copies will be furnished on request while the supply lasts.